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Evaluation of ICT in Education in Papua Province

(ACDP-045)

FINAL REPORT

June, 2015

**The Education Sector Analytical and Capacity Development
Partnership**

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The Government of Indonesia (represented by the Ministry of Education and Culture, the Ministry of Religious Affairs, and the Ministry of National Development Planning/ *BAPPENAS*), the Government of Australia, through Australian Aid, the European Union (EU) and the Asian Development Bank (ADB) have established the Education Sector Analytical and Capacity Development Partnership (ACDP). ACDP is a facility to promote policy dialogue and facilitate institutional and organizational reform to underpin policy implementation and to help reduce disparities in education performance. The facility is an integral part of the Education Sector Support Program (ESSP). EU's support to the ESSP also includes a sector budget support along with a Minimum Service Standards capacity development program. Australia's support is through Australia's Education Partnership with Indonesia. This report has been prepared with grant support provided by Australian Aid and the EU through ACDP.



The institutions responsible for implementation of the study were the Australian Council for Educational Research (ACER), the University of Sunshine Coast and Willi Toisuta and Associates (WTA), on behalf of Cambridge Education.



The members of the study team who prepared this report were:

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University of Sunshine Coast:	Mr John Hunt
Willi Toisuta and Associates:	Mr Eka Simanjuntak, Professor Eko Sedyono, Professor Prapto Yuwono, Dr Sri Yulianto, Dr Wigati Yektinintys Modouw

The views expressed in this publication are the sole responsibility of the authors and do not necessarily represent the views of the Government of Indonesia, the Government of Australia, the European Union or the Asian Development Bank.

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The views expressed in the report are those of the authors and not necessarily of any other individual or organisation.

Project Team

Australian Council for Educational Research
University of the Sunshine Coast
Willi Toisuta & Associates
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Abbreviations and Acronyms

	English	Indonesian
ADB	Asian Development Bank	
ACDP	Analytical and Capacity Development Partnership	
ACER	Australian Council for Educational Research	
ADSL	Asymmetric Digital Subscriber Line	
BECTA	British Educational Communications and Technology Agency	
BPMP	Multimedia	Balai Pengembangan Multimedia Pendidikan
BPP	Balai Pengembangan Pendidikan	Balai Pengembangan Pendidikan
BYOD	Bring Your Own Device	
CSR	Corporate Social Responsibility	
DFAT	Department of Foreign Affairs and Trade	
DIKPORA	Dinas Pendidikan dan Olah Raga /Dinas Pendidikan Technology Group	Dinas Pendidikan dan Olah Raga /Dinas Pendidikan
DP	Dinas Pendidikan	Dinas Pendidikan
EMIS	Education Management Information System	
F2f	Face-to-face	
FM	Frequency Modulation	
GSM	Global Systems Mobiles	
ICT	Information and Communication Technologies	
ITB	Institut Teknologi Bandung	Institut Teknologi Bandung
ITU	International Telecommunications Union	
KKOS	School Operators Working Group (Jayapura)	
KPG	Teacher Education Colleges	Kolese Pendidikan Guru
LCR	Learner to Computer Ratio	
LEOS	Low Earth Orbit Satellite	
MEOS	Mid Earth Orbit Satellite	
MoEC	Ministry of Education and Culture	
MT	Islamic Junior Secondary School	Madrasah Tsanawiyah
OECD	Organisation for Economic Cooperation and Development	
PD	Professional Development	
PKBM	Community Learning Centers	Pusat Kegiatan Belajar Masyarakat
PISA	Programme for International Student Assessment	
PLIK	Internet	Pusat Layanan Internet Kecamatan
PLN	Power	Perusahaan Listrik Negara

PPG	Papuan Provincial Government	
PSB	Learning Resource Centre	<i>Pusat Sumber Belajar</i>
PSTN	Public Switched Telephone Network	
RKAS	Work Plan and Budget School	<i>Rencana Kegiatan dan Anggaran Sekolah</i>
SD	Basic School/Primary School/Elementary school	<i>Sekolah Dasar</i>
SEAMEO	Southeast Asian Ministers of Education Organization	
SEAMOLEC	Southeast Asian Ministers of Education Organization Regional Open Learning Centre	
SEA Edu-Net	South East Asian Education Network	
SMA	Senior Secondary School	<i>Sekolah Menengah Atas</i>
SMK	Technical and Vocational High School	<i>Sekolah Menengah Kejuruan</i>
SMP	Junior Secondary School	<i>Sekolah Menengah Pertama</i>
SMPLB	Extraordinary Secondary School	<i>Sekolah Menengah Pertama Luar Biasa</i>
TEI	Teacher Education Institutions	
ToR	Terms of Reference	
TPD	Teacher Professional Development	
TV-E	Education	<i>TV-Edukasi</i>
TVRO	Television receive only	
UN	Public national examinations	
UNCEN	Universitas Cenderawasih	<i>Universitas Cenderawasih</i>
UNESCO	United Nations Educational, Scientific and Cultural Organization	
UPI	Universitas Pendidikan Indonesia	<i>Universitas Pendidikan Indonesia</i>
USC	University of the Sunshine Coast	
VSAT	Very Small Aperture Terminal (parabolic antenna)	
WTA	Willi Toisuta & Associates	
WVI	Wahana Visi Indonesia	<i>Wahana Visi Indonesia</i>

Glossary of Terms

BOS	School Operational Assistance program provided by the Ministry of Education for basic education block grants
BOSDA	BOS <i>Daerah</i> funds provided as local school grants to supplement those provided by the Ministry of Education in the basic education block grants
DIKPORA	Provincial education office
Dinas Pendidikan	Kabupaten (or regency) education office

Executive Summary

Context

Papua in eastern Indonesia is a province of about 3 million people, with the majority of the population living in over 3000 villages spread throughout remote lowlands and highlands, swamps and coastal areas. Papua province generally has few roads and minimal electrification and telecommunications infrastructure, especially in remote locations. Papua has high rates of poverty, illiteracy, and school non-retention, and it is among those provinces with the lowest success rates in national school examinations. Rural and remote areas within Papua province have the poorest educational outcomes.

- Minimal electricity & telecommunications
- Low school retention & exams success
- Vision of cluster digital lessons, ICT PD & ICT for education data
- ICT vision re pedagogical change & knowledge deepening/creation
- Indonesian ICT competency framework for teachers

The use of ICTs has been highlighted as an essential strategy for lifting the quality of educational experiences and improving life outcomes across Papua. The ICT vision in recent years has been increasingly focused on ensuring fully-integrated internet interconnections across provincial offices, districts and schools. This requires that high bandwidth fibre optic wireless broadband is available in accessible areas or low bandwidth satellites operate wherever this is not feasible.

Cluster-based ICT Centres providing digital learning lessons and professional development across schools, as well as the strengthening of ICT capacity for improving educational data management and information systems, comprise significant aspects of the vision and strategy for ICT in education in Papua. For more remote locations, establishing small elementary schools within community learning centres and provision of quality television programs has been important in contributing to the achievement of Papua's educational vision.

New pedagogical approaches for educational delivery underpin the Papuan vision for using ICTs in education. Teacher capacity building goes beyond merely building ICT competencies, instead being focused on teachers using a wider range of pedagogies which help students to become collaborative, problem-solving, and creative learners in readiness for 21st century citizenship and work life. In the UNESCO *ICT Competency Framework for Teachers* (2011), three key phases are involved:

- **Technology literacy:** enabling students to use ICT to learn efficiently;
- **Knowledge deepening:** building student skills to acquire in-depth knowledge and apply this to real world problems; and
- **Knowledge creation:** creating new knowledge to build fulfilling and prosperous societies as citizens and workers.

Indonesia's *ICT Competency Framework for Teachers* (MoEC, 2012) is adapted from the UNESCO model. Framed within Ministerial Regulation No. 16 Year 2007 on Teacher Competency, the ICT competency framework focuses on teachers as global educators who are digitally connected and accessing diverse knowledge and learning resources, as well as sharing knowledge and creativity to varied audiences in many different locations. The framework has many features aligned to the UNESCO model including technology literacy,

knowledge deepening, and knowledge creation. An additional competency in the Indonesian framework is knowledge sharing.

Objectives

The *Evaluation of Information and Communication Technologies (ICT) in Education in Papua Province* study is a large-scale research project for the Republic of Indonesia's Education Sector Analytical and Capacity Development Partnership (ACDP). The key objectives of the Study are:

- To measure the effectiveness of the TV-Edukasi (Education) (TV-E) and other ICT programs in the Province and to determine their impact on the learning outcomes of school children and adult learners; and
- To make recommendations to plan for further ICT in education initiatives.

ICT programs and study details

Details of the ICT programs which are the focus of the study are:

- *TV-Edukasi*: two educational TV channels, one channel for students, one for teachers;
- *Portal Rumah Belajar*: adaptation of TV content for mobile devices;
- *School Net/Jardiknas*: national programs connecting schools to the Internet;
- *ICT Centres and locally-based programs* e.g. Digital Learning for Teachers Professional Development;
- *ICT for non-formal education*: TV-E packages to support adult literacy, and
- *South East Asia Education Network (SEA Edu-Net)*: resources repository for teachers sharing resources.

Evaluation objectives

- TV-E effectiveness
- Other ICT programs
- Impact on learning outcomes
- Recommendations for the future of ICT

Specifically the study focuses on TV-E and other ICT programs in three areas. The evaluation involves conducting:

1. An initial assessment of the geographical availability and reach of ICT infrastructure in Papua (study area 1);
2. A systematic evaluation of the respective ICT programs within a framework to examine the system set-up and implementation of the programs (study area 2), and
3. An evaluation of the TV-E and other ICT Programs to estimate the impact of such programs (study area 3).

Research questions

Relevant to study area 1 are the following research questions:

- What is the penetration of broadcast television (FM), Internet services (PSTN, ADSL, LEOS & MEOS) and mobile/cell phone services (GSM)?
- What infrastructure was intended for TVE and the five other ICT programs?

Relevant to study area 2, are the following questions about implementation:

Topics/ Characteristics	Potential Questions
1. Vision and political commitment	<ul style="list-style-type: none"> What policy, management strategies, structures and plans have been put in place at provincial and district level to ensure successful installation, maintenance and use of TV-E and other ICT equipment in Papua?
2. ICT infrastructure	<ul style="list-style-type: none"> Are the TV-E packages in working order? What other ICT infrastructure (other than TV-E packages) do schools have to complement the TV-E program? Are they in working order and how was the equipment obtained? How did/ who made the decisions on which schools should receive which ICT tools (e.g. TV/ generator/ solar panel/ DVD player)? Considering the remoteness of many schools, how are Papuan schools sourcing energy to use ICT? What are the strengths and weaknesses of different sources of energy (including renewable energy sources)?
3. Teaching and learning	<ul style="list-style-type: none"> How is the TV-E being used for teaching and learning? How are other ICT equipment being used for teaching and learning? Are they being used to complement the TV-E program or in a separate program?
4. Learning materials	<ul style="list-style-type: none"> What are the most watched TV-E programs for teaching and learning? Are the DVDs and CDs supplied to accompany the TV sets useful? What other ICT-based teaching and learning materials are available in schools and how are they used?
5. Skills development	<ul style="list-style-type: none"> How are the ICT skills of educators and principals developed to ensure the e-readiness of TV-E and other ICT in education programs?
6. Institutional arrangements	<ul style="list-style-type: none"> What are the challenges and opportunities of using TV-E programs in these schools? How is ICT and power source equipment maintenance being carried out? How are the recurring costs being covered? How are broken/out of date ICT equipment being replaced?

Relevant to study area 3, the research question is:

- What are the impacts of ICT programs on teacher and student learning?

Research methodology

The study has involved quantitative and qualitative data collection, including surveys, interviews/focus groups and case studies. The survey phase focused on collecting data from a stratified, representative sample of 220 Papuan schools. This included 220 principals, 1505 teachers and 3127 students from across eight regencies. There were 107 SD schools and 113 SMP schools in the sample. This sample was represented by 110 urban schools, 67 peri-urban schools and 43 remote schools. About 75% of schools were ICT program schools, with equipment and services provided by the government. About 25% were non-ICT program schools which may have had programs of their own or programs provided by universities/Yayasans. Twelve schools from across four regencies were involved in interviews and focus groups comprising principal, teacher, student and parent participants. Interviews were undertaken with officials representing two universities and two KPGs, Dinas Pendidikan, telecom, and training

- Survey of 220 schools
- 12 schools interviews/FGD
- Interviews: TEIs, education leaders, telecommunications
- Case studies in 4 locations

organisations, BPP and other staff in provincial education offices. Case studies were conducted in four locations of Jayapura, Keerom, Merauke and Nabire.

Findings

ICT educational infrastructure and ICT programs

TV-Edukasi and other targeted ICT programs were introduced in Papuan schools to facilitate educational and financial management, to build knowledge and to nurture student empowerment for the purposes of improving student learning outcomes.

TV-Edukasi (a national program owned by MoEC) established TV channels for education purposes, with channel 1 being for students and channel 2 being for teachers. In Papua Province 1135 schools received hardware such as TVs, TV receivers, DVD players and sometimes generators/solar panels/parabolic antenna. Professional development was provided to about 1500 teachers through BPP ICT Centre (Papua Education and Culture Office), with positive feedback received about this. Maths, language, biology/physics and natural science CDs/DVDs were also distributed. The TV-Edukasi service was suspended in Papua in 2012.

- Two TV channels: students, teachers
- TVE equipment & PD provided for 1135 schools
- Pustekkom national ICT Centre role
- TVE (including CDs): 30-40% use by respondents
- TV based materials increasingly questioned in emerging online era
- ICT Centres and concerns re internet provision and costs

Pustekkom, the national ICT Centre (MoEC) in Jakarta, was responsible for the delivery of online teaching and learning services (eg Portal Rumah Belajar), for professional learning, and for connecting schools to the Internet via Jardiknas and School Net.

TV-Edukasi channels and CDs/DVDs were valued by those accessing them, but only 30-40% of respondents indicated use (mostly less than weekly). Almost half of principal survey respondents indicated no use at all. The most used TV-Edukasi materials were news, science and technology, sports, arts/folk dancing, maths and associated quizzes, and English language learning programs. The teacher channel provided additional resources for lessons and supplied information about national exams and new teaching techniques. TV-E materials were most often used when teachers were absent. There were concerns expressed about TV-Edukasi, including equipment items being broken or inappropriate (e.g. screens too small for class groups), lack of power and Jakarta time zones being incompatible for Papuan classrooms or materials being culturally inappropriate.



Beyond issues about the frequency of use of TV-Edukasi, there are questions to be considered about the future of TV-based materials in the age of high quality and engaging online materials, which are available anytime, anywhere and which can cater very effectively for individual student needs and interests.

Regarding other ICT programs, about 10% of survey respondents were accessing Portal Rumah Belajar and SEA-EduNet. Usage of School Net, Jardiknas and ICT Centres was closer to 20%. Sixty ICT Centres, together with some mini labs and stations in elementary

schools, were established. Schools were provided with a varying number of computers, laptops and DSL networking, sometimes with VSAT and power. Despite relatively low usage, those accessing the services were positive about their value. ICT Centres provided professional development opportunities for teachers and leaders and new learning resources were accessible online. There were widespread concerns expressed from many schools about having no internet, intermittent internet services or slow internet speed. High internet costs from access occurring through private providers was another concern raised.

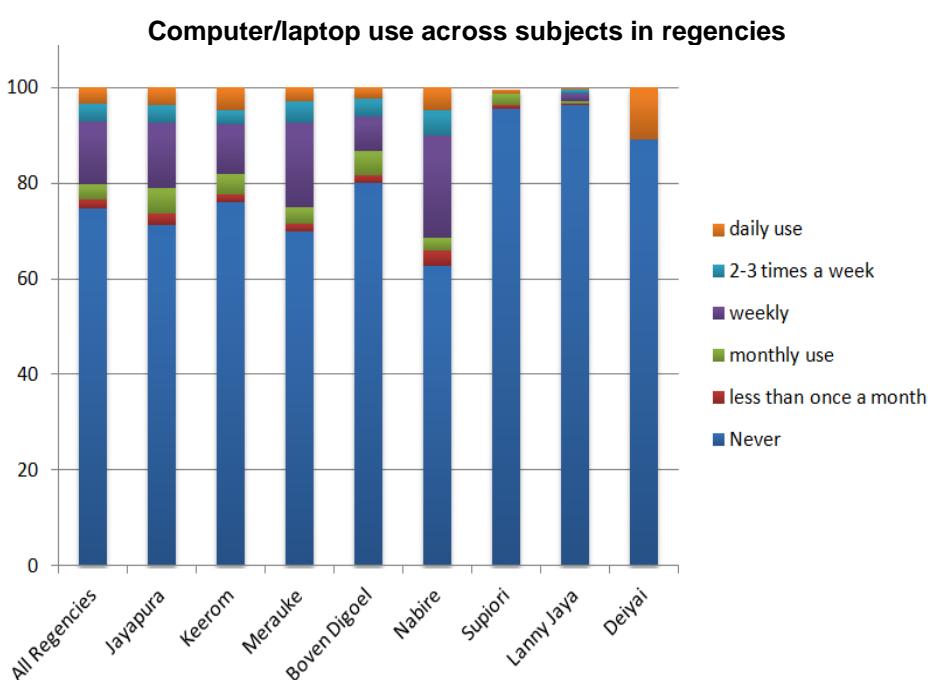
Other ICTs

Other ICTs being used by schools for teaching and learning or administration included computers, laptops, LCD data projectors, digital cameras, and various software items. Generally, schools surveyed had less than five computers; with about 50% having only 1-2 hardware items or none. There were few laptops, generally only one or two per school, and there was an absence of tablets. About 40% of schools had only one or two LCD projectors or no LCDs at all.

Despite ICT traditionally being a compulsory specialist subject, *about 75% of students were not using computers/laptops in a computer room or in their subjects*. Only about 20% of students indicated at least weekly use of ICTs.

- Schools: less than 5 computers; 50% 1-2 computers
- ICT subject compulsory but 75% students are not using computers at school; regional differences
- Only 20% students have at least weekly computer use
- 73% students have no access to internet at school
- 70% teacher computer use for admin, not classroom
- ICT can support 21st century learning skills but little understanding exists

As the table indicates, for some regencies, such as Supiori, Lanny Jaya, and Deiyai, there was virtually no computer or laptop use in subjects.



Students and teachers indicated that the compulsory weekly computer lessons were essentially focused on basic computer processes, especially Word, Excel, and PowerPoint, rather than on more creative programs. Almost 73% of students had no internet access at school. Many students indicated that they owned laptops or mobile technologies but these were not permitted to be used at school.



Teachers and principals used a range of ICTs at school more frequently than students. About 70% of teacher ICT use was for administration such as assessment and reporting to parents or curriculum preparation work, rather than also for teaching and learning use in the classroom.

Laptop and computer use on a regular basis was more common among principals than teachers. Regular internet use was not particularly high, occurring regularly by only 27% of teachers and principals. Email use was more prevalent among principals (22%). Tablets were used infrequently by either principals or teachers.

The table below provides details.

Principal/teacher frequency of use of ICTs

Principals N=218			Teachers N=1500	
	Daily/ 2-3 times week %	Never	Daily/ 2-3 times week %	Never
Computers	42.9	41.1	27.3	48.5
Laptops	60.8	27.4	41.8	37.8
Tablets	10.3	88.3	11.4	82.6
Internet	27.1	55.0	28.2	56.3
Email	22.7	52.8	11.7	68.4

Key messages emerging from the findings highlight a need for greater student access to a wider range of ICT hardware and to a broader range of software and ICT opportunities. Enhancing teacher pedagogical skills to better understand the potential for learning arising from more classroom ICT use by students is essential. Echoing the UNESCO ICT Competency Framework for Teachers (2011), as introduced previously, most teachers seem to be working with their classes at the technology literacy stage. There is an urgent need to build teacher and principal understanding about the potential of ICTs in learning. ICTs can support wider student engagement in the learning process and the building of 21st century skills such as creativity, problem solving, being an independent learner and collaboration.

Telecommunications and other infrastructure in Papua

In the urban/peri-urban locations, the telecommunications infrastructure supporting ICT involves satellites for telephone/internet, radio and

- Limited access to telephone, internet in remote
- Only 30% electrification; urban areas unstable power

TV. There is limited, if any, access to telephone and internet in remote places. Once the Palapa Ring East is operational in 2015, it is expected that the fibre-optic cable will improve telecommunications for Jayapura, Merauke, Sarmi, Biak, Timika, Supiori and Sentani. More mobile satellites might be expected to become available for Nabire, Lanny Jaya and Keerom, potentially improving their services. Minimal improvements for remote locations can be anticipated although there are innovations such as ‘Telco in a box’ which offer a potential solution.



Power challenges exist in Papua with only about 30% electrification, and with unstable power existing in these urban and sub-urban areas. Seventy-eight percent of primary schools and 8% of secondary schools are reliant on diesel generators for night time use. This study highlights remote location educational improvements being reliant on overcoming power challenges by investing in solar, wind, geothermal, mini hydro or hybrid processes.

School Planning and funding for ICT

In consideration of funding for ICT, one-third to half of schools indicated this occurred through Indonesian government block grants, Papuan government grants, Kabupaten finance, and also through Yayasan funds (11%, and parent contributions (25%).

- 68% schools spending below Rp 20,000,000 for ICT, mostly on electricity or maintenance, or internet
- Few schools with detailed ICT purchase plans

Of money spent on ICT, 68% of schools were spending below Rp 20,000,000 and 13% spent in the range of Rp 20,000,000-40,000,000. Half of schools indicated significant costs for electricity, and almost a quarter of them indicated maintenance and internet spending were significant costs incurred. Only 8% of schools were spending significantly on new equipment and 18% on equipment replacement.

There were few detailed ICT purchase plans available, with most schools buying not more than 1-2 items annually (or none at all), operating within BOS requirements.

Professional Development for ICT

TV-Edukasi planning and the 2010-2014 ICT Implementation Strategy highlighted the importance of professional development (PD) for improving the data skills of office based staff, for building the ICT leadership skills of principals and for increasing the basic computer skills of teachers. The role of Teacher Education Institute (TEI) staff in supporting the professional development activities was also highlighted.

It was evident from the surveys and interviews that BPP had provided PD regarding TV-E for about 1500 teachers and principals, with over 95% of principals and teachers who accessed these sessions indicating value. Other PD provided regarding various targeted ICT

- Few schools with PD plans for ICT
- Most ICT PD through individual effort; peer learning
- Minimal school/regency/district ICT PD
- District-sponsored communities of practice valued
- Universities/KPG: minimal ICT in pre-service program
- Universities/KPGs: only minor role in teacher ICT PD

programs was also useful. However, generally, clear roles for ICT PD support through provincial, regency/district and school levels have not been clearly outlined, with schools not having ICT PD plans and with principals considering PD to be a government responsibility. Most ICT PD occurs through individual efforts and peer learning. There was minimal school/regency/district ICT PD identified. There were some valued district-sponsored subject based communities of practice (CoP). Teams indicated that these groups meet regularly to discuss various issues including ICT. Surprisingly, there was evidence that universities and KPGs have a minimal ICT focus in their pre-service programs. They played a minor role in teacher ICT PD, with their own ICT infrastructure being poor.

Future needs for ICT and related PD are:

- an increase in specialist workshops for principals and teachers re ICT pedagogy;
- more formal and ongoing networking in school/district communities of practice, and
- Universities/KPGs establishing ICT infrastructure, with skilled staff, and a curriculum including ICT pedagogical practices

Impact of ICT on teacher and student learning

Students, teachers, principals and parents all value ICT for their own learning. About 96% of principals and teachers believed ICT helped them to learn. Those students having access to ICT (about 71%) also believed it helps their learning (although many students indicated very minimal ICT use at school).

As the table shows, over 90% of principals and teachers cited ICT benefits for learning of students in terms of knowledge, collaboration, creativity and communication.

- Most people value ICT for own learning
- 90% principals/teachers cited ICT benefits for learning of students: creativity, knowledge, communication,
- 20-30% teachers/principals cited ICT difficult to understand
- 47% teachers, 21% principals self-rated as capable/very capable in ICT skills
- 80% remote principals; 50% teachers rated selves low in ICT capability
- Teachers using ICT at basic Technology Literacy levels in classrooms, not for Knowledge Deepening or Knowledge Creation

Principal/teacher valuing of ICTs for learning

	Principal N=220		Teacher N=1505	
	Strongly agree %	Agree %	Strongly agree %	Agree %
I think computers help students to work collaboratively	34.1	54.1	35.2	54.9
I think computers allow students to develop good communication skills	36.8	54.5	41.2	50.8
I think using ICT develops creativity in students	44.1	50.0	46.7	48.6
I think computers are a necessary tool for learning	58.9	37.0	45.5	48.3

Some 20-30% of teachers and principals found ICT difficult to understand and frustrating and 95% believed they needed to increase their own skills before allowing their students to use IT. Only about 47% of teachers and 21% of principals self-rated as capable/very capable in terms of ICT skills. About 75% of principals indicated they were 'not at all capable,' compared to 41% of teachers. Males and younger teachers and principals self-rated as more capable than others. There were also significant locational differences, with over 80% of remote location principals giving themselves a low rating, together with 50% of teachers.

Students also believed that ICTs helped their learning, with almost all of those students having access to computers indicating this [although with up to two-thirds of students indicating they have no access at school in some locations e.g. Supiori (70.4% no access), but also Lanny Jaya (42.8% no access) and Deiyai (32.7% no access); many of these students also had little access to ICTs at home]. Students provided many examples of learning with ICTs including broadening knowledge of other cultures and experiences unavailable to them in Papua, social learning through working collaboratively with ICTs, creative experiences and becoming independent learners.

Regarding student capability, 11.4% of students rated themselves as 'very capable' and 41.7% as 'capable', with 43.9% indicating 'not at all capable'. There were no gender differences evident. Students in senior classes rated themselves as very capable or capable more than students in grade 5 and lower classes. Urban students were about twice as likely to rate themselves as capable or very capable compared to remote location students.

Policy implications and ways forward

Principals, teachers, parents and students indicated the value of ICT for learning and believed that it impacts positively. It is very important that education leaders at all levels continue to develop and coordinate ICT plans and then to fund and implement these. The right equipment, time for appropriate professional learning and investment into ongoing monitoring of expenditure, quality and impacts, are further essential requirements for success and form the basis of proposed policy areas.

Policy implications and associated ways forward may be outlined as follows:

Policy implications	Ways forward
<p>At the national and provincial level, priorities for successful and sustainable ICT uptake include:</p> <ul style="list-style-type: none"> Developing an across-Ministries plan and/or policy (e.g. Joint Decree across Ministries), as well as resourcing, to improve telecommunications and power infrastructure such that all locations in Papua have access to these services. This in turn will improve internet connectivity generally and give remote schools better access to web based materials. Negotiating with various funders to ensure sufficient and targeted budgets are provided. This will enable Papuan provincial authorities to develop detailed long-term plans outlining both subsidies for devices, technical support, maintenance and professional development, and processes for monitoring. Developing a coordinated plan and implementing strategies for ICT in schools including clear roles for provincial bodies such as BPP, TEIs, LPMP, districts and schools and sufficient and sustainable funding and monitoring. 	<ul style="list-style-type: none"> At the broader level, it is essential that solutions for sustainable power and improved telecommunications infrastructure are investigated and acted on, building on innovations which are underway in remote locations, and using schools as focal points with related benefits occurring for communities e.g. health, childcare. A systematic, coordinated and sustained approach to ICT development in Papua is required. It must include an increased range and quantity of equipment, specialist ICT coordinator staff in regencies; technical support and monitoring. This process will involve Provincial, regency, district, and school levels, with planning occurring in an integrated manner and with sufficient resourcing and timeline to enable programs to be sustained and maintained into the future.

<ul style="list-style-type: none"> • Reconsidering policies about provision of ICT equipment and ensuring there are clear formal responsibilities outlined, using subsidies which seek commitment in terms of contributory funding, and more synthesised approaches to planning and monitoring. • Establishing and implementing a coordinated professional development plan for ICT using expert advice focused on relevant pedagogies and integration of ICT into subjects, including a mix of specialist sessions. Furthermore, establishing communities of practice at the school and district level and through professional associations to underpin professional development through peer-to-peer learning. • Revisiting ICT professional development focal areas to ensure a greater emphasis on building an understanding across all leaders and teachers about the potential for ICT to develop 21st century skills. Aspects of this will include problem solving, collaboration, creativity, independent learning. 	<ul style="list-style-type: none"> • Sustained and ongoing provision of subsidies for the purchase of government-preferred ICT equipment must be actioned. This will enable all schools to purchase from a range of digital devices (e.g. laptops, ultra-portables, tablets, mobile phone technologies etc), that can be used for educational purposes for students and teachers. • There is a need for ICT professional learning (provincial, TEI, district, school based) related to updating the skills of all teachers and leaders (especially female, more mature and those in remote locations), and building pedagogical skills. In ICT, pedagogical skills must be a focus for all principals and teachers, and these pedagogies need to move towards integration with the curriculum for the purpose of knowledge deepening and knowledge creation and enhancing 21st century skills. Skills such as student creativity, group work, deep learning, problem solving must be a part of this. Province, TEIs, regency/districts and schools need to establish a coordinated approach, with specialist ICT coordinator leaders providing this, especially at regency levels.
<p>At the regency/district level, priorities for successful and sustainable ICT uptake relate to:</p> <ul style="list-style-type: none"> • Supporting and strengthening district based subject and leader communities of practice groups and establishing expectations for schools to create in-school groups. Also providing time for school-based community of practice groups to meet regularly, formally and informally and to support each other in ICT skills and knowledge development. • Developing targeted PD for female teachers and leaders, as well as for more mature staff and for those in remote locations to build their ICT skills. • Developing a coordinated plan and implementing strategies for ICT in schools including clear roles for TEIs, LPMP, districts and schools and with sufficient funding and monitoring to ensure success. 	<ul style="list-style-type: none"> • There is a need for ICT professional learning (provincial, TEI, district, school based) related to updating the skills of all teachers and leaders (especially female, more mature and those in remote locations), and building pedagogical skills. In ICT, pedagogical skills must be a focus for all principals and teachers, and these pedagogies need to move towards integration with the curriculum for the purpose of knowledge deepening and knowledge creation and enhancing 21st century skills. Skills such as student creativity, group work, deep learning, problem solving must be a part of this. Province, TEIs, regency/districts and schools need to establish a coordinated approach, with specialist ICT coordinator leaders providing this, especially at regency levels. • The planning and implementation of flexible student teacher preparation programs within universities and KPGs is necessary for the successful integration of ICT across the curriculum, in accordance with the expectations of Curriculum 2013. Universities and KPGs must be funded for the acquisition of facilities and staff to focus on ICT integration and related pedagogical issues.

<p>At the school level, priorities for successful and sustainable ICT uptake relate to:</p> <ul style="list-style-type: none"> Establishing communities of practice within the school which meet regularly, with teachers supporting each other in ICT skills and knowledge development, including sharing pedagogies which enhance student skills as independent learners and knowledge builders. Developing a school plan which builds a positive ICT culture and implementing strategies, with sufficient funding and monitoring to ensure success. 	<ul style="list-style-type: none"> There is a need for ICT professional learning (provincial, TEI, district, school based) related to updating the skills of all teachers and leaders (especially female, more mature and those in remote locations), and building pedagogical skills. In ICT, pedagogical skills must be a focus for all principals and teachers, and these pedagogies need to move towards integration with the curriculum for the purpose of knowledge deepening and knowledge creation and enhancing 21st century skills. Skills such as student creativity, group work, deep learning, problem solving must be a part of this. Province, TEI, regency/districts and schools need to establish a coordinated approach, with specialist ICT coordinator leaders providing this, especially at regency level. School budgets that target ICT must be provided. This includes ICT related expenses such as network infrastructure (external, internal to school), digital devices, training and professional learning activities, sharing good teaching practices, technical support and maintenance, and provisions for safety and security.
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Chapter 1: Introduction

1.1 Background and aims of the study

The *Evaluation of Information and Communication Technologies (ICT) in Education in Papua Province* study is a large-scale research project for the Republic of Indonesia Education Sector Analytical and Capacity Development Partnership (ACDP).¹ The key objective of the study is to measure the effectiveness of the TV-Edukasi (Education) (TV-E) and other ICT programs in the Province and to determine their impact on the learning outcomes of school children and adult learners. Another purpose is to make recommendations to plan for further ICT in education initiatives. In this report 'ICT programs' is a phrase used to refer collectively to the respective ICT programs covered in this evaluation: that is TV-E, Portal Rumah Belajar and School Net/Jardiknas. ICT Centres and locally-based programs such as Digital Learning for Teachers Professional Development, ICT for non-formal education, and South East Asia Education Network (SEA Edu-Net) are among other ICT programs of interest. In this report, schools involved in the study which were specifically provided with access to any of these programs are referred to as 'ICT program schools'. Schools involved in this pilot study which did not have such access provided to specified programs are referred to as 'non-ICT program schools'. These 'non-ICT program schools' may have obtained ICT access through universities, Yayasan or other groups.

1.1.1 Evaluation objectives

The evaluation objectives are focused on examining systems implementation processes and their effectiveness and on finding out about the impact of various ICT initiatives on the learning outcomes of school children and adult learners throughout the Province. The development objectives of this evaluation are to contribute towards improving access to quality education, particularly in the most remote, underserved and poorest districts in the Province through the use of technologies. The outcomes of this study are intended to strengthen the implementation and improve the performance of ICT education programs in Papua, by widening access to education through the provision of ICT infrastructure and digital learning materials to schools and community-based learning centres. An outcome from the study may be to provide insights into the possible gaps between policy and implementation.

Specifically the study will focus on TV-E and other ICT programs by conducting:

1. An initial assessment of the geographical availability and reach of ICT infrastructure in Papua;
2. A systematic evaluation of the respective ICT programs within a framework to examine the system set-up and implementation of the programs, and
3. An evaluation of the TV-E and other ICT Programs to estimate the impact of such programs.

An outcome from the initial assessment of the geographical availability and reach of ICT infrastructure may be policy recommendations for which type of ICT program(s) will be most appropriate for which level of connectivity.

¹ The ACDP was established by agreement between the Government of Indonesia (GoI), the Government of Australia, the European Union (EU) and the Asian Development Bank (ADB) as a facility to promote dialogue and institutional reform of the education sector to underpin policy implementation and help reduce disparities in provincial and district education performance. Co-financing arrangements exist between these agencies.

Related aspects included are about evaluating the capacity of education staff to use ICT in education resources, and also the regulatory and policy requirements that will support ICT programs in education, particularly in schools.

1.1.2 Research questions

Relevant to focus area 1 and the initial assessment of geographical availability and reach of ICT infrastructure in Papua are questions such as:

- What is the penetration of broadcast television (FM), Internet services (PSTN, ADSL, LEOS & MEOS) and mobile/cell phone services (GSM)?
- What infrastructure was intended for TV-E and the five other ICT programs?

Relevant to focus area 2 about implementation and a systems framework (about vision and commitment, ICT infrastructure, teaching and learning, learning materials, skills development and institutional arrangements), are the following questions:

Vision and commitment:

- *What policy, management strategies, structures and plans have been put in place at provincial and district level to ensure successful installation, maintenance and use of TV-E and other ICT equipment in Papua?*

ICT infrastructure

- *Are the TV-E packages in working order?*
- *What other ICT infrastructure (other than TV-E packages) do schools have to complement the TVE-E program? Are they in working order and how was the equipment obtained?*
- *How did/ who made the decisions on which schools should receive which ICT tools?*
- *Considering the remoteness of many schools, how are Papuan schools sourcing energy to use ICT? What are the strengths and weaknesses of different sources of energy (including renewable energy sources)?*

Teaching and learning

- *How is the TV-E being used for teaching and learning?*
- *How are other ICT equipment being used for teaching and learning? Are they being used to complement the TV-E program or in a separate program?*

Learning materials

- *What are the most watched TV-E programs for teaching and learning?*
- *Are the DVDs and CDs supplied to accompany the TV sets useful?*
- *What other ICT-based teaching and learning materials are available in schools and how are they used?*

Skills development

- *How are the ICT skills of educators and principals developed to ensure the e-readiness for TV-E and other ICT in education programs?*

Institutional arrangements

- *What are the challenges and opportunities of using TV-E programs in these schools?*
- *How is ICT and power source equipment maintenance being carried out?*
- *How are the recurring costs being covered?*
- *How are broken/out of date ICT equipment being replaced?*

Regarding to the third area for the evaluation, that of impact, the specific research question is:

- What are the impacts of ICT programs on teacher and student learning?

Further details about the research questions including systems framework questions, as outlined in the Terms of Reference document, are presented in Appendix 1.

1.1.3 Research questions and report structure

The three evaluation areas and various research questions are used to structure the chapters in this report. Initial chapters are concerned with big picture infrastructure, with middle chapters related to implementation and systems framework aspects and final chapters related to impact on learning.

Details of the chapters are as follows:

Chapter 1: Introduction: This chapter outlines key evaluation areas; related research questions and the ICT programs; literature review and introducing the current study.

Chapter 2: Design and Methodology: This chapter describes the sample design; development of instruments; field study operations; main data collection and collation; data analysis and survey participant demographics.

Chapter 3: Telecommunications and Other Infrastructure: This chapter introduces the current Papuan telecommunications and energy infrastructure and also some future initiatives (as relevant to some of the focus area 1 and the associated research questions).

Chapter 4: Educational Policies, Organisational Infrastructure and ICT Programs: This chapter describes the big picture Indonesian context for ICT and also introduces the specified ICT programs in more detail and the policy and organisational context in which these programs have been operating (as relevant to some of the focus area 2 research questions relevant to Vision and Commitment, ICT infrastructure and also Skills Development).

Chapter 5: Teaching and Learning using ICT Program Materials: This chapter presents the survey and interview/focus group results in regard to TV-Edukasi and other ICT programs, including specific uses of various materials and the overall usefulness of various programs (as relevant to Teaching and Learning questions and also Learning Materials questions for focus area 2 and the associated research questions).

Chapter 6: ICT Centres and Related ICT Programs: This chapter captures the survey and interview/focus group results in regard to ICT Centres and their usefulness, including future directions (as relevant to Teaching and Learning questions for focus area 2 and the associated research questions).

Chapter 7: Other ICT for Teaching, Learning and Administration: This chapter outlines the survey, interview/focus group and case study information in regard to computers, laptops, DVDs, digital cameras and other equipment, as well as how ICT is used by students and teachers (as relevant to Teaching and Learning questions for focus area 2 and the associated research questions).

Chapter 8: Infrastructure, Planning and Funding for ICT: This chapter outlines the survey, interview and case study information from principals in regard to computers, laptops and

other hardware, as well as planning and funding for ICT and the associated challenges (as relevant to ICT infrastructure and Institutional Arrangements questions for focus area 2 and the associated research questions).

Chapter 9: Professional Development for ICT: This chapter presents the context for professional development at the policy, province, regency/district and also the school levels and including the role of universities and the KPGs. The chapter also refers to survey, focus group and case study interview information (as relevant to Skills Development for focus area 2 and the associated research questions).

Chapter 10: ICT impact on Teacher and Student Learning: This chapter focuses on impacts of the ICT programs from the perspectives of students, teachers and principals, as outlined in surveys, interviews and focus groups (as relevant to focus area 3 and the associated research question).

Chapter 11: Summary: This chapter re-introduces the research questions and specific evaluation objectives and synthesises various data sources.

Chapter 12: Policy Implications and Ways Forward: This chapter outlines some policy directions and ways forward for the future of ICT in education in Papua.

1.2 Papuan education context

1.2.1 Education in Papua

The Papua education system consists of over 2600 schools at various levels, with high dropout rates and with many students repeating various year levels. There is a low rate for student transfer from elementary to junior secondary school (Modouw, 2011).

On various education development indexes, Papuan scores are among the lowest in Indonesia. For example, about 107,000 students or 25% of those aged 7-12 years are not enrolled for school (Dikpora Papua, 2012). The SMP/MTs (Junior Secondary School/Islamic Junior Secondary School) Net Enrolment Rate is 37.6% which is only about half of the national average (Ikhtisar Data Pendidikan Nasional Tahun, 2011/2012). Student performance on the Ujian Nasional/UN (National Final Examination) is only 6.71 percent compared to a national average of 7.04 percent, with the province failure rate being one of the worst in Indonesia (Kemdikbud, 2013). Only 15% of children in Papua have access to early childhood facilities unlike the situation in Java where about 90% of children have such access. There are similar access difficulties in regard to proximity to SMP schools. Teacher attendance at schools and low level qualifications are other issues which impede quality education to a greater degree in Papua than in other parts of Indonesia (ACDP, 2014a; Sparrow & Vothknecht, 2011).

Beyond the Papua school specific context, electricity and basic water supply services are lacking in the school facilities provided and in the community generally, with only a 30.4% electrification rate (IFAD, 2009). Schools and communities rely on low capacity solar cells provided by local PLN (Perusahaan Listrik Negara) or use generators for night time lighting (Sparrow & Vothknecht, 2011). About 78% of primary schools and 8% of secondary schools are in remote coastal or highland locations, with lack of power making education difficult especially given that ICT is increasingly playing a role in this context (Sparrow & Vothknecht, 2011).

1.2.2 ICT in education support structures in Indonesia and Papua

For many years Indonesia has been using technologies to try and improve its educational performance and the overall quality of the teaching and learning processes. The national education technology agency Pustekkom (Centre for Information and Communication Technology for Education) was established in 1978 with the specific, expressed purpose of delivering educational content to schools. Pustekkom is based in Jakarta and is responsible to the Ministry of Education and Culture (MoEC). The initial focus for Pustekkom was on the provision of audio/radio and video/film/television content (Pustekkom, 2012). However in 2005, Pustekkom was given a wider brief to include a broader range of technologies in education. This brief was formalised in 2008 through the development of a mandate to plan and provide ICT infrastructure, services and professional development for education (Pustekkom, 2012).

In 2010, the Ministry of National Education (now Ministry of Education and Culture) released the national *2010-2014 MoNE Strategic Plan* (Renstra) that confirmed an emphasis on infrastructure, online learning, online services (management, reporting and governance), professional learning and the establishment of ICT centres. The aim was to establish an ICT Centre in each district in order to provide Internet access to the district office and nearby schools, with schools being mostly connected by wireless.

Several Papua ICT in education initiatives have been established and these operate across various institutions, as well as more widely across sectors. Two main programs of interest are Community Learning Centres and Teacher Education Colleges.

The Community Learning Centers or PKBM initiative was pioneered in 1998. Through a project of Strategic Plan of Villages Development or RESPEK², ICT equipment such as TVs, DVD player, radio and satellite discs was supplied to villages. The objective was to use ICT to establish distance learning programs related to literacy, life skills, and second chance education through *Kejar Paket A, B, and C programs*. The teaching and learning process at these community learning centers was facilitated by local facilitators. However, questions have been raised in recent years about their use and impact (Studi Perencanaan Strategis, 2014; Modouw, 2011).

KPGs or Teacher Education Colleges are institutions established only in Papua to accommodate its unique geographical, demographical and social and cultural conditions. KPGs seek to overcome the lack of teacher education and training and to meet the demand for teachers in rural, remote and isolated areas. Four KPGs have been established in Nabire, Mimika, and Merauke (also Sorong which is currently in West Papua), thereby seeking to address the lack of teachers who can adapt to Papuan unique conditions. However, more than 12 years since their establishment, KPGs have faced challenges of insufficient funding and low human resource capacity. Additionally, ICT was expected to play a pivotal role, in terms of reaching indigenous communities in remote and isolated areas, not only for education, but also for health and other basic services (Studi Perencanaan Strategis, 2014). This ICT role is far from realised.

1.2.3 ICT vision for Papua

Given various national and specific supports for Papuan education such as Pustekkom resources and establishing KPGs to provide teachers for remote location schools, the vision established was about using ICTs as an essential strategy for lifting the quality of

² RESPEK: Rencana Strategis Pengembangan Kampung / Villages Development Strategic Plan.

educational experiences and improving life outcomes across Papua. A key aspect of the ICT vision became increasingly focused on ensuring fully-integrated internet interconnections across provincial offices, districts and schools. High bandwidth fibre optic wireless broadband being available in accessible areas is part of the vision, supported by low bandwidth satellites operating wherever possible (ACDP, 2014 citing World Bank, 2009; Modouw, 2011). Cluster-based ICT Centres involving digital learning lessons and professional development across schools; and strengthening ICT capacity for improving educational data management and information systems, have been other significant aspects of the strategy (ACDP, 2014 citing World Bank, 2009; Modouw, 2011). Another aspect has been providing access to digital curriculum resources and to distance education, thereby supporting teachers who face challenges in engaging students in learning through traditional approaches and materials (ACDP, 2014 citing World Bank, 2009; Modouw, 2011). Keerom's pilot project (Modouw, 2011) in partnership with the University of Education, Indonesia (UPI) and the Institute of Technology Bandung (ITB) and providing inservice teacher professional development through blended learning (face-to-face and weekly online sessions), will be outlined in more detail in other sections of this report.

For more remote locations, given lack of telecommunications infrastructure for internet and digital learning, access to educational TV programs, DVDs, and radio and provision of power sources and antennae were viewed as part of the solution. 'Affirmative education' was an approach which involved establishing small elementary village schools within community learning centres, which included grades 1-3 and learning centres, boarding house, day care centre, library and play group. Sub-district schools for years 4-9, also with boarding schools sports facilities and school gardens were also part of the vision to ensure the needs of students in more remote locations were met and then with international standards schools for primary /elementary school level in districts and at secondary level in provinces were part of the vision. The intention was that learning of students and adults would be supported through provision of quality television programs. Televisions, generators/solar panels, satellite dishes, parabolic antennas and DVD players and CDs of resources were provided, including through a community based empowerment project. Professional learning was also intended (Modouw, 2011). Further details are provided in other sections of this report.

1.2.4 Strategic planning for ICT in Papuan schools

Consistent with the vision, at a national level, planning for ICT in education in Papua has been supported through the province overarching education plans such as the Ministry of National Education (MoNE) *Rencana Strategis Pendidikan Provinsi 2010-2014*. This plan emphasises e-administration and e-learning, with digital learning materials provision to schools and community based learning centres being used as a key strategy to widen education access for both children and adult learners in Papua (Dikpora Papua, 2010).

The *ICT in Education Strategy and Implementation Plan for Education in Papua* (The World Bank, 2010), took account of connectivity, access, quality, learning and accountability issues. The plan also acknowledged the special challenges confronting ICT in education in Papua by planning three phases of implementation for the purposes of achieving significant change in infrastructure, teacher professional development, education and financial management, and learning resources. The total estimated cost of the three phases was indicated as being about US\$31 million, including almost 11 million for ICT Centre infrastructure, about 1 million for maintenance and about 1.3 million for teacher professional development.

The *ICT in Education Strategy and Implementation Plan for Education in Papua* proposed 60 ICT Centres as the focus for teacher professional development (The World Bank, 2010). The

plan had Dikpora Papua (Office of Education and Sport) support through establishment of three secondary school ICT Centres for each of the 20 districts (with 31 districts operating in recent years). Each ICT Centre was to be allocated up to twenty laptops, a server computer and a satellite (VSAT) terminal. In addition a learning resource centre was planned for training, and provision of high speed copying and a small video facility was intended (The World Bank, 2010). Secondary and middle schools not selected for ICT Centres were to be allocated 'minilabs', with the provision of ten computers and connection to VSAT (or to Palapa Ring fibre-optic network where possible). Remote basic primary schools were to receive an ICT station and one computer. Schools were also encouraged to acquire computers for administration, and for use in teaching and learning.

1.3 Introducing ICT programs for evaluation

1.3.1 TV-Edukasi (TV-E)

A number of interventions using ICT have occurred in Papuan schools and communities in the last decade and these programs are a key focus for the current evaluation. These ICT programs have sought to improve the access of students and adults to opportunities for learning. The programs are briefly outlined in this chapter (using various sources of infrastructure including those outlined in the ToR for this evaluation). Further details will be provided in Chapter 4 of this report.

TV-Edukasi (TV-E) was an Indonesian television station owned by the Ministry of Education and Culture (MoEC) which served to spread information to the education sector. The station was made official by the Indonesian Education Minister Abdul Malik Fadjar on October 12, 2004. Currently, TV-E nationally has two channels with scope for local adaptation: channel 1 for students and channel 2 for teachers. Schools involved in the TV-E program were provided with hardware including television equipment, DVD player, a satellite dish, also radio and other materials to support teaching and learning. It is understood that the local TV-E channel was turned off in Papua in 2012. About 1135 schools received TV-E hardware in 2006, 2007, 2010 and 2011, with costings for this hardware component being estimated at above US\$10 million.

1.3.2 Portal Rumah Belajar or m-edukasi

Portal Rumah Belajar or m-edukasi was developed by Balai Pengembangan Multimedia Pendidikan (BPMP) Semarang under the coordination of Pustekkom, with a focus on adapting some of the TV subject matter for use on mobile devices.

1.3.3 School Net/Jardiknas

School Net/Jardiknas was a national program to connect schools to the Internet and a Wide Area Network. In 2013, about 300 basic (SD), junior secondary (SMP) and senior secondary schools (SMA) in Papua were linked through the School Net/Jardiknas connection. Increased access to Rumah Belajar online materials was intended (<http://belajar.kemdikbud.go.id>). The site was also intended to provide resources for learning and virtual classrooms for e-learning³, together with online professional development about curriculum for teachers (The World Bank, 2010). However, decreasing connectivity was

³ E-learning refers to the use of technologies and digital materials to support learning. The term includes online distance learning.

evident in recent years as schools increasingly made their own purchase arrangements for internet.

1.3.4 ICT centres and related programs

ICT Centres throughout Papua and various district initiatives are part of the current evaluation. These Centres were initially established in various regencies including Jayapura, Keerom, Nabire and Merauke, with a focus on ICT and professional development. SMK and SMA schools were the key centres, with connections established to various SD, SMP and other schools. About 44 schools were part of the ICT Centre project.

District based programs were also established in ICT Centres. For example, in Keerom there was a program from 2009-2011 called the *Digital Learning for Teachers Professional Development* program (which is also referred to as the 'Teacher Open Lesson' program). This program operated in partnership with Universitas Pendidikan Indonesia (UPI) and Institut Teknologi Bandung (ITB). The objective of the program was to provide professional development in mathematics and science teaching and learning for primary school teachers in the Keerom District. This model was intended for wider dissemination in other districts.

1.3.5 ICT for non-formal education or community learning centres

As previously introduced, the Community Learning Centres were established through the issuance of the Papua Special Autonomy Law 9 (2001), with the Papuan education office then supporting the Badan Pemberdayaan Kampung (Village Empowerment Agency). The intention was to implement non-formal education activities to eradicate adult illiteracy using technologies in remote villages. ICT equipment was supplied to the villages including TV, DVD player, radio and satellite discs.

1.3.6 SEA Edu-Net

SEA Edu-Net was a network which had a broad coverage in South East Asia enabling it to be used for open and distance learning and data sharing among South East Asian teachers. In 2009, eight nodes or distance learning hubs/facilities were set up in the Papuan cities of Biak, Merauke, and Jayapura.

SEA Edu-Net provided a resources repository for all subjects. The aim of the initiative was to build networks of teachers who developed and shared resources 'by teachers and for teachers'. More recently, the SEA Edu-Net Edmodo⁴, a virtual class platform for teachers, has been established to support interactive communication and learning. It has been re-named SEA Edu-Net 2.0.

SEA Edu-Net has been supported by the Southeast Asian Ministers of Education Organization (SEAMEO) which publishes a monthly online magazine.

1.3.7 Summary of ICT programs

This contextual review details ICT in education activities in Papua, and indicates that over the past decade considerable activity has occurred to implement ICT in education programs.

⁴ Edmodo is a social learning platform similar to *Facebook*, that is designed specifically for teachers, students, and parents

There has been some professional development (PD) to accompany these programs but little consistent data is available about PD nor about the impact of the programs. This study sets out to investigate the degree to which these programs have had an impact on teaching and learning, as well as on student and adult learning outcomes.

To inform this study, a brief review of the research literature about the developing countries and ICT context and about the indicators of impact of ICT in teaching and learning is provided below.

1.4 Developing countries and ICT context

1.4.1 UNESCO education directions

The ICT program in Papua needs to be considered within the broader context of developing countries and international organisations which are setting big picture targets and working on long term projects to support economic and social advancement. The Millennium Development Goals focus, established by the United Nations for 2000-2015, has eight improvement targets. Two of these goals have particular relevance, these being focused on education and on gender equity. The education target is about achieving universal primary education. The gender equity target is about empowering women, with girls from the poorest 60% of households being three times more likely to be out of school than those girls from wealthy households. Marriage and child rearing are high expectations from an early age. As the 2015 timeframe draws to a close in terms of United Nations targets, some achievements include more children than ever in developing regions attending primary school and reaching 90% in 2010 (compared to 82% in 1999). However, essentially the goal has not been reached, with 10% of children or 58 million of school aged children being out of school in 2012 (UNESCO, 2015).

The post-2015 directions are now being considered, with sustainable development and sustainable population planning being a focus. Two key issues are becoming identified for potential future targets, including the importance of offering education in developing countries using mother tongue, as well as the national language. The second emerging issue for education is about the use of ICT and also about every child being equipped with relevant skills for the 21st century including critical thinking, creativity, collaboration and life skills. Education going beyond conventional methods and basic literacy and numeracy and integrating ICT into learning and teaching processes, has become a key focal area. Additionally, the importance of ensuring effective teacher professional development in pedagogy, also involving ICT and building understanding of learner-centred approaches, has been identified as an essential focus (UNESCO, 2015).

1.4.2 ACDP directions in Indonesia

Mother tongue language and focusing on teachers and the importance of their role in education are also two key projects within the Analytical and Capacity Development Partnerships (ACDP) work within developing countries like Indonesia.

The teacher absenteeism research project in Indonesia, including Papua, has identified issues and factors in teacher absenteeism and also various strategies for improvement. These strategies include building principal leadership and involving them in management training so that they can help teachers to productively use their non-teaching time. This

training includes approaches to establish school-based professional learning which expands the range of pedagogical practices (ACDP, 2014a).

The mother tongue languages project in Papua has similarly highlighted the need for strategies to encourage all students to attend school and for retention beyond the initial years. The potential for ICT and computer based word processing to reduce costs and to produce instructional materials in multiple languages has been recognised (ACDP, 2014b).

1.4.3 UNESCO ICT Competency Frameworks for Teachers

Further support for teachers in developing new pedagogical approaches to build student interest in learning and to improve educational outcomes can be seen in the development of ICT competency frameworks for teachers. These frameworks go beyond merely identifying ICT competencies and teachers working with ICTs in the classroom in a technical manner to show students how to use ICT hardware. Instead the frameworks are about focusing on teachers using a wider range of pedagogies which help students to become collaborative, problem-solving, and creative learners and to build their skills in readiness for 21st century citizenship and work life.

For example, in the UNESCO *ICT Competency Framework for Teachers* (2011), 3 key phases are involved:

- Technology literacy: enabling students to use ICT to learn efficiently
- Knowledge deepening: building student skills to acquire in-depth knowledge and apply this to real world problems
- Knowledge creation: creating new knowledge to build fulfilling and prosperous societies as citizens and workers.

Key component domains for development across these phases include ICT tools use, understanding the role of ICT in education curriculum and assessment; pedagogy; teacher professional learning; organisation and administration.

Set within the 'knowledge-driven economy' concept and the Indonesian Master Plan for the Acceleration and Expansion of Indonesian Economic Development (and connectivity; strengthening of the national human resources; science and technology areas), Indonesia's *ICT Competency Framework for Teachers* (MoEC, 2012) is adapted from the UNESCO model. Framed within Ministerial Regulation No. 16 Year 2007 on Teacher Competency, the ICT competency framework focuses on teachers as global educators who are digitally connected and accessing diverse knowledge and learning resources, as well as sharing knowledge and creativity to varied audiences in many different locations. The framework has many features aligned to the UNESCO model including technology literacy, knowledge deepening, knowledge creation. However an additional one is knowledge sharing. Domains are similar to the UNESCO model, as shown in Table 1:

Table 1: Key Elements of Indonesian ICT Competency Framework for Teachers

Domain	Criteria	Literacy	Knowledge Deepening	Knowledge Creation	Knowledge Sharing
Policy	Policy understanding & classroom practice	Understands & responds to national ICT policy	Implements policy	Integrates policy	Provides input to policy
Curriculum & Assessment	Curriculum planning Learning environment Student experience Assessment Special Education Needs	Designs learning activities using ICT tools and guides students towards mastery and assesses	Develops curriculum, authentic learning, guiding students & measuring using ICT, including for students with special needs	Integrates tools, develops authentic learning for higher order thinking; guides students to evaluate information for new learning, develops measuring tools for self assessment, integrates for special needs	Develops ICT based curriculum for collaboration and sharing, creating networks, & for measuring student learning
Pedagogy	Planning Problem/project based learning (PBL) Student experience Communication & collaboration	Uses ICT to explore tools for PBL & cater for individual development, and for communication/ collaborative work	Designs, uses ICTs for PBL & for improving student collaboration	Develops ICT skills for resources for higher order thinking; manages PBL with ICT; facilitates student collaboration through ICT	Develops ICT learning design within collaborative community; publishes PBL using ICT; communicates in ICT based learning community nationally/ internationally
ICT	Productivity tools Authoring tools Internet Communication & collaboration Administration	Uses various software & simple multimedia & internet, also using ICT for administration	Uses open-ended software for mastery of subjects; uses various multimedia; performs search optimisation & evaluation using internet applications; uses communication tools; optimises ICT to evaluate learning	Uses & facilitates students in using various software, internet, multimedia for creativity & innovation;; facilitates students creating collaborative projects; develops virtual learning environment to document learning	Evaluates open-ended software for learning; shares use of multimedia authoring; shares learning resources to create learning environment; builds network of professionals; optimises virtual learning environment for reporting learning
Organisation & Administration	ICT integration Management of Learning Activities Ethical use of ICT	Managing ICT resources & identifying role of ICT, with understanding of norms for use	Manages student learning in technology-enriched environment & uses various ICT tools	Being pioneer of ICT based innovations; develops strategy for ICT for student centred learning & develops ethics policies for using ICT responsibly	Developing school as example of ICT based learning organisation & encouraging others to use ICT ethically
Professional Development (PD)	Planning Teacher Awareness and Participation Informal Learning Research & Reflection	Uses ICT to identify PD needs, identifying variety of online professional communities & using ICT for self development identification of needs & for reflection	Uses various ICT for PD & utilising online professional communities; using various ICT for self development & to formulate learning problems	Conducts self evaluation on ICT based PD & on professional activities, actively participates in online professional community & research	Gives ideas about needs of ICT based PD; facilities development of online professional community and actively contributes and publishes research results

(Source: Adapted from MoEC, 2012)

1.4.4 ICT in schools

Beyond research projects which recognise ICT potential generally for supporting pedagogical change in teaching approaches, are those which examine specific devices and materials and seek to identify the impact on student learning outcomes. UNESCO and other research work in Africa, the Middle East, in Asia and in other developing countries, have embraced trialing of various technologies for learning in schools (Buck, McInnes and Randolph, 2013; UNESCO, 2012a; UNESCO, 2012b; Project Tomorrow, 2012). Buck, McInnes and Randolph (2013) have identified some learning advantages for low income students who are provided with mobile phone technologies, noting improvements in their standardised test results by as much as 30% following mobile phone technology use.

Laptop, tablet and mobile phone devices have been particularly recognised as useful in school education, especially due to their accessibility, portability and affordability. Laptops have been valued over desktop computers by many schooling systems for their portability and offsite power storage capability (Hamel, nd). Mobile phone technologies such as smartphones have been especially highlighted for developing countries because of their low costs, long term power storage capacity and speed of accessibility (Goundar, 2011).

Some systems and schools in various locations where there is pressure on school funds have been placing responsibility on students and families to supply their own technological devices for learning at school. While some programs require specific laptop brands, operating systems and software on these devices, other schools permit students to bring whatever devices are available to them including mobile phone technologies. While there are potential problems such as theft and classroom distractions, the advantages of 'bring your own device' (BYOD) approaches outweigh the disadvantages (Ray, 2013). The BYOD approach releases any available school technology equipment for those students without any devices available to them so that they also have ICT access in the classroom (Project Tomorrow, 2012; UNESCO, 2012a; UNESCO, 2012b).

Mobile phone technologies in Africa, the Middle East and Asia have also been closely considered in various research projects, both in terms of disadvantages and advantages. Some research among parents in these developing countries contexts has indicated the valuing of traditional teaching approaches and examinations (Takeuchi, 2011; Shin, 2011), with parents concerned about mobile phone technologies regarding student gaming addiction and inappropriate online content access (UNESCO, 2012b). However there is also generally recognition of the positive benefits of mobile phone technologies for learners:

...learners and teachers, as consumers, will use mobile phones for a variety of purposes which are likely to include education. Mobile phones lend themselves to personalised, informal, self-directed and situated learning, which makes the growth of mobile learning more likely at the individual level (UNESCO, 2012a: 34).

Beyond a role in informal learning, the UNESCO paper highlights the role of government and formal education systems in promoting mobile technologies for formal learning:

For mobile learning to grow and be institutionalised in formal education systems, governments will need to play a more proactive role in promoting the use of mobile phones for teaching and learning, as well as for the administration and management of education systems and institutions (UNESCO, 2012a: 34).

1.4.5 UNESCO ICT in Education indicators

Other UNESCO work to assist member countries to develop an ICT policy has involved establishing a set of indicators for decision makers to consider in measuring ICT in education progress. Domains include Political commitment, Infrastructure, Teaching staff development; Curriculum; Usage; Participation, skills and output; Outcomes and impact.

These domains and the associated policy questions and indicators are shown in Table 2 below.

Table 2: Domains and policy questions for ICT in education indicators

Conceptual domains	Potential policy questions	Mapping of information requirements
Political commitment	Do countries have deliberate policies and incentives that constitute an enabling environment for ICT integration into their national education system?	Presence of national and/or education sector-specific policy, plan or regulatory framework for ICT implementation strategy
Infrastructure	To what extent do the schools in a country have access to ICT in support of teaching and learning process?	Quantity and quality of ICT facilities or related resources in schools for educational purposes
Teaching staff development	What proportion of teaching staff is adapting their competencies to an ICT-enabled instruction model or to teach ICT subjects?	Training and deployment of teachers to use ICT in education
Curriculum	Are countries introducing changes in their curriculum delivery using ICT, and to what degree are ICT taught as a subject?	Extent of integration of ICT into the curriculum
Usage	What are the nature and intensity of ICT use in schools?	Access to ICT in schools (as proxy measure for usage)
Participation, skills and output	What is the evolution in structure (all fields versus ICT fields) of the skills or outputs produced annually by national education systems?	Stock of learners trained in basic computer skills and/or graduated in generic and specific ICT-related fields of study
Outcomes and impact	<p>Are ICT transforming education systems' performance or making a difference in:</p> <ul style="list-style-type: none"> improving conventional teaching and learning processes? enhancing the quality of student performances? expanding new skills supply for labour market? enlarging lifelong learning opportunities? managing educational institutions? 	<ul style="list-style-type: none"> Evidence of the reforming role of ICT in the traditional face-to-face education delivery systems (effects on curriculum delivery and contents) Differential success rates of learners in schools with ICT assisted instruction versus students in schools with conventional pedagogy (as proxy measure for impact) Increase in the number of computer literates and the range of ICT-related fields of study graduates (ISCED 4, 5 and 6) Increased enrolments in ICT-enhanced outreach or on-the-job training programmes and of certifications in new skills obtained by individuals outside the formal education system. Increased presence of computers in educational administrations or increased use of computers for school management

(UNESCO Institute for Statistics, 2009)

This matrix provides a broader structure for the development of policy and needs consideration by the highest echelon of the Papuan Provincial Government. Many of the issues raised here are addressed in the policy and recommendations elsewhere in this report.

The UNDP *Human Development* report (UNDP, 2012) emphasises ICT readiness and the importance of technology for improvements in all aspects of life. Aspects of this framework which relate to e-readiness and the ICT in education indicators in Table 2 are:

- Political will and commitment (fair, open, transparent decision making and demonstrating how and why ICT fits);
- Infrastructure and connectivity (sustained and considering various solutions based on geographic location);
- Trained technical support provision;
- Access to sustainable range of ICT hardware;
- ICT PD differentiated for participants (principal, teachers, administrations), and
- Dedicated monitoring and evaluation staff (UNDP, 2001).

1.5 Background literature about indicators of impact

1.5.1 ICT, teaching and learning, and student performance

The benefits of incorporating technologies into teaching and learning in Indonesian schools have been recognised for some time. In 2002, Yuhetty argued for the integration of technologies into school education in order to build the international competitiveness of the nation, but noted that the lack of suitable infrastructure constrained such initiatives (Yuhetty, 2002). In 2014, there are still debates in Indonesia about the integration of technologies into school education. The introduction of the new school curriculum in 2013 has seen the Indonesian government cancel computing as an independent subject and instead there is an expectation that learning with technologies will be infused across the curriculum (Vota, 2014). This approach to the curriculum is consistent with several jurisdictions in the USA, but is not consistent with other nations such as Australia. In Australia, 'computing' as a subject is taught, while also having an expectation that the use of technologies is incorporated into teaching and learning across the broad range of discipline areas (ACCE, nd).

While this evaluation is concerned with the role that ICT can play in improving student learning outcomes in Papua, the link between ICT and enhanced student outcomes is generally unclear in various research studies in a range of contexts. Some research in developed nations suggests that marginal achievement benefits may be possible where blended learning involving face-to-face and online approaches occurs (Tamin, Bernard, Borokhovski, Abrami & Schmid, 2011; Means, 2010; Means, Toyama, Murphy & Baki, 2013). In comparison however, in both developed and developing nations, the research does generally suggest that there are pedagogical advantages to teaching and learning with ICT (see for example ICT lessons learned series 2004, 2004; United Nations Educational, Scientific and Cultural Organisation, 2014). A common theme in this research is that with the use of technologies, teachers are provided with a wider choice of teaching strategies (Beetham & Sharpe, 2013). In addition, there are intuitive conveniences associated with ICT, such as access to a wider selection of resources, the capacity to share resources globally, the ability to use communication services for collaboration and networking, and also to access information (Zittrain, 2008). Furthermore, information, media and technology skills are increasingly viewed as essential for the 21st century, with teachers considered to have significant roles in supporting the development of these skills to prepare students for futures-oriented work and life (Partnership for 21st Century Skills, 2008).

The research literature has also identified learning theories and pedagogies that can benefit from teaching and learning with the Internet. Constructivist learning theories that emphasise interaction, dialogue and knowledge creation (e.g. Vygotsky, 1978; Bruner, 1961) can be extended with technologies (Harasim, 2012). Being connected with a diverse group of learners who are focused on common content and learning processes using the Internet can also be beneficial for students (Siemens, 2004). Furthermore, the Internet can encourage teaching approaches such as inquiry learning, collaborative learning, personalised learning, self-directed learning, project based learning and problem solving (Harasim, 2012; Laurillard, 2012). Social networking can be beneficial to teaching and learning when it is led by an experienced educator who focuses on the processes of learning (White, 2012). Although Gurell, Kuo & Walker (2010) have found that students can be easily distracted from their studies while using the Internet, especially with undertaking social networking activities, a problem-solving approach can reduce the degree of distraction students demonstrate.

One consistent message from the research about ICT in education however, is that there are many variables that interact with each other. This makes the identification and measurement of causal relationships between technologies and student performance hard to identify. Variables relevant for this study are:

- teachers' willingness and proficiency to use technologies in teaching and learning;
- concepts of access to technologies (telecommunications, hardware and software);
- the provision of digital services (content and functionality);
- infrastructure acquisition and maintenance;
- teacher professional development, and
- school planning for the use of ICT.

These issues are explored further below.

1.5.2 ICT and teachers

Teachers are essential to the successful implementation of teaching and learning with ICT. They can be both an asset and a barrier to students' use of ICT. Given significant professional learning time and regular opportunities to share good practices with colleagues, successful implementation becomes less random and diffusion of practices occurs. Teachers require collegial support at their personal level of competency or they will not engage with learning how to include technologies into their suite of pedagogies. Teachers may find that accessing ICT is time-consuming (Bingimlas, 2009; British Educational Communications and Technology Agency (BECTA), 2004). If the use of technologies in teaching and learning is made too hard, avoidance becomes the escape. One of the most noticeable motivators for teachers to include ICT into their teaching and learning however, is when they can see the potential benefits for improving students' learning outcomes.

The literature in both developed and developing countries suggests there are a number of pre-conditions for ICT to make a difference to learning. Teachers have to be supported in their shift to a wider range of ways of working. Some have called this developing 'digital pedagogies' (Beetham & Sharpe, 2013). This occurs when teacher professional development (TPD) is targeted to address specific issues of direct concern to teachers, is well supported, and is accessible and relevant. Teachers have to receive 'differentiated' support in learning how to use technologies in their classrooms (Tomlinson & Allan, 2000), where differentiated teaching focuses on the individual needs of each child. Teachers benefit from seeing other teachers modeling how good learning is planned and executed in classrooms. Teachers require access to a range of technologies that can be used in ways

that meet specific learning objectives for students. Teachers also have to learn to use technologies in ways that are not too overwhelming for them or their students.

Teachers in Papua have special requirements. A case study in Merauke isolated four major factors affecting the low quality of high school graduates in Merauke Regency. These factors comprise teacher competence, student attendance and motivation for learning, parental support, and teaching and learning facilities and infrastructures (Werang, Betaubun & Leba, 2014). The research by Werang et al. (2014) provides added impetus for the professional development of teachers, especially where a new learning environment such as teaching and learning with digital technologies is considered. However, ICT can provide virtual classrooms for teachers, in the same way that these classrooms can be provided for students with remote teachers.

The possibility of virtual professional development is promising in order to overcome geography and time limitations, particularly where communities of teachers with a common purpose and motivation for learning about teaching as well as sharing good practices are able to meet online (Burns & Bodrogini, 2011). A pilot study in Keerom reported on a trial where computers in a number of classrooms were successfully connected. Bandang and Langi's (2011) work indicates that using teleconference and IP telephony systems encourages more interaction between students and teachers, although limited bandwidth and wireless connectivity can be disruptive to audio and visual transmissions. There is an indication from this trial that Internet connectivity needs to be reliable and robust to be successfully used in teaching and learning.

The main issue for improving student learning outcomes remains 'the general education levels of teachers and the frequency of participation in teacher working groups [that] correlate with learning in school' (Pradhan & de Ree, 2014:10). Even though teacher participation in professional learning seems to be fundamental to the improvement of student learning outcomes, this strategy explains some of the differences in student achievement between schools.

Change in education comes about through strongly supported professional development for teachers and follow-up in the workplace (Timperley, 2007). The research literature indicates that teacher professional development is essential for the adoption and use of ICT in teaching and learning because teachers require content, pedagogical and technological knowledge (Mishra & Koehler, 2006). This requirement compares with past practices where teachers required expert content and pedagogical knowledge (Shulman, 1986). New teachers require both expert discipline knowledge and technical, content and pedagogical knowledge to enable technologies to be meaningfully included into classroom practices (Mishra & Koehler, 2006). Further, the use of ICT in teaching and learning requires new skills such as the ability to undertake online searches, validation of content, publishing and more, with these skills needing to be taught. Such pedagogical skills can only be used when teachers are confident, and the barriers to accessing functional infrastructure are minimised. Therefore, sustained professional learning for teachers in teaching and learning with ICT is essential (Trinidad, Newhouse & Clarkson, 2005). Sustained professional learning is beneficial because it accommodates 'innovators' who are more willing to adopt new approaches, along with the 'laggards' who are skeptical and require extensive time and evidence of successful practices of ICT in education (Rogers, 2003).

1.5.3 Overcoming the barriers to the use of ICT by teachers

Barriers to the adoption of digital technologies for teaching and learning by teachers have consistently been reported in the research literature (Bingimlas, 2009; BECTA, 2004). Network reliability, teacher professional learning and a motivation to enhance teaching

practices and student achievement, are essential factors in the success of moving towards 'digital normalisation' in education (Lee & Broadie, 2014).

In a review of the literature about the barriers to teachers in using technologies in their classrooms, Bingimlas (2009) has identified the following common causes:

- lack of teacher confidence;
- lack of teacher competence;
- resistance to change and negative attitudes;
- lack of time;
- lack of effective training;
- lack of accessibility to the IT infrastructure, and
- lack of technical support.

Of these causes, the main constraints identified in the Bingimlas (2014) study were teachers' lack of confidence with using technologies, and poor network access, time and support. More recent research indicates that teachers develop ICT skills where it becomes necessary, while they remain focused on improving their students' learning outcomes (Bennett, 2014). Furthermore, teachers express their interest in technologies when they have a belief in the value of that technology as a crucial factor towards enhancing their teaching practices (Bennett, 2014).

These findings are pertinent for the Papuan education context given that one of the purposes of this study about the use of technologies is to contribute towards improving the quality of education in the most remote, underserved and poorest districts in the Province.

1.5.4 ICT infrastructure

Since ICT in education has been mooted as a valuable approach to improving the quality of teaching and learning and to overcoming issues of remoteness and geography, then issues concerning the access to suitable ICT infrastructure have also been raised (Moyle, 2010; Moyle & Owen, 2009). In developed nations, the emphasis on using ICT in teaching and learning has shifted away from the deployment of desktop computers to mobile devices such as laptops, tablets and mobile phone technologies (Lunden, 2014). The use of television as an education tool slipped out of 'ICT in education' programs late in last century (Moyle, 2010). In developing countries, the trend towards using mobile devices, especially mobile phone technologies, has become marked (eLearning Africa, 2014). The use of mobile phone technologies enables developing countries to avoid building extensive ground or telephony infrastructure (Roy Morgan Research, 2013).

In this evaluation, ICT in education includes television broadcasting, satellites and the hardware and software deployed to support teaching and learning in schools and communities across Papua. Television broadcasting, using an analogue signal, as well as other digital technologies, is included in discussions about 'ICT in education' in Papua.

The challenge for many countries can be the amount of content downloaded from satellites as satellite downloads of content can often exceed Internet network capacity (The World Bank, 2010). Therefore, in reviewing the infrastructure capacities for this evaluation, a distinction has been made between the capacity to deliver content and the capacity to share content interactively with others. Where these two functions are combined, with adequate bandwidth, the issues of distance and geography can be moderated for the purposes of accessing and using information. Furthermore, sharing content with individuals and groups in locations that are connected by the Internet can be supported.

However, the learner to computer ratio (LCR) in Indonesia is quite high at 136:1 in 2012 (ITU, 2014). This means that access to devices and infrastructure for educational purposes is low. The ITU report also shows that Indonesian schools' access to the internet is 42%, although this figure refers only to primary and lower secondary schools and not upper secondary schools (ITU, 2014). While this information is available for the whole of Indonesia, the actual student to computer ratio in Papua is unknown.

1.6 Research gaps

There is a lack of consensus in the research literature about how children learn with ICT even though promising pedagogies have been identified. Confusion is evident in the findings of the Programme for International Student Assessment (PISA) although there do seem to be indications that students who use computers at school, as well as at home, are more successful on PISA tests than students who use computers only at school (OECD, 2011). Indeed, students who use computers only at school would appear to achieve lower PISA achievement results, in comparison to other students who use computers both at home and at school (OECD, 2011). Importantly, for the Papuan context, the involvement of the community to develop a home school partnership would appear to be important in effective learning with technologies.

This evaluation aims to establish some baseline data that will help to inform future policies for using ICT in education to improve the quality of teaching and learning in schools in Papua.

1.7 The current study

The *Evaluation of ICT in Education in Papua Province* study (ACDP-045) involves quantitative and qualitative data collection. The principal, student and teacher surveys have collected data from representative regencies involving a stratified, geographic and topographic mix of schools, to reflect the conditions and school contexts across the whole of Papua. Interviews and focus groups in a smaller sample of schools have been used to gain deeper insights into specific issues that emerged from analyses of the surveys. Some case studies in selected locations and contexts have occurred to provide in-depth information about specific aspects of relevance. Interviews with key education and telecommunications officials have also been undertaken.

The survey phase of the evaluation has involved collecting data from a stratified, representative sample of 220 Papuan schools. About 80% of the schools were those involved in ICT programs, with equipment and services provided by the government. About 20% of the schools surveyed were not provided with government support for specified ICT programs, and thereby constitute the 'non ICT program schools' in this study. It was recognised that some of these 'non ICT' schools may possibly have ICT programs of their own or ones provided by universities or Yayasanans.

Information and Communication Technologies, for the purposes of this study and report, includes communication devices such as radio, television, mobile phones, computers, laptops, tablets and network hardware and software, as well as satellite systems and the internet.

1.8 Summary

This chapter has introduced the Indonesian education and ICT context and the ICT programs which are the focus for this study, as well as outlining the global context and relevant literature.

Chapter 2: Design and Methodology

This chapter describes the design and methodology of the study, including the development of instruments, sampling and field data collection practices. To supplement the chapter, the following appendices are included in a separate document:

- Appendix A: *Research Questions and Sub-questions*
- Appendix B: *List of Schools and Details*, providing details of sample schools by regency, location, school type and whether ICT program school or not
- Appendix C: *Data Instruments*
- Appendix D: *Data Collation Report*, providing details of data collection and collation processes
- Appendix E: *Case Studies*, outlining successful operation of specific aspects in various regencies and districts
- Appendix F: *Survey Data Key Items*, providing Facts and Figures Snapshot
- Appendix G: *Selected Detailed Survey Tables*
- Appendix H: *Survey Participant Demographics*
- Appendix I: *Principal Survey Responses to 4 year ICT Improvements*
- Appendix J: *Total Estimated Costs for ICT in Education Strategy and Implementation Plan*
- Appendix K: *Indicative ICT Program Costs for Ways Forward.*

2.1 Sample design and methodology

The research methodology has involved the collection of quantitative and qualitative data including surveys, interviews/focus groups and case studies.

The sample design involved a three-stage stratified sample design being implemented following consultation and considering local contexts. In the first stage, using information about schools obtained from the Ministry of Education and Culture (MoEC), a sampling frame was constructed. This frame considered various identifiers about the school and whether it was provided with ICT program materials. Regencies representative of geographic and topographic districts were identified, with the four paired regencies eventually being selected after consultation with local education authorities.

In the second stage, the cost of reaching various types of districts and safety of various areas was considered, with easier to reach and safer locations being over-represented in the sample.

The final stage involved selection of specific schools, with about 80% being ICT program schools and about 20% being non-ICT program schools. The sample included SD (primary) and SMP (junior secondary) schools in about equal proportions, and similarly seeking approximately equal numbers of public and private schools, thereby reflecting the population of Papuan schools as a whole.

2.1.1 Sample of regencies and districts

Determining the sampling districts and regencies involved various stratification processes. The first stage of stratification used a sampling frame including the location of the school, school type, sector and level. Schools which were provided with TV-E packages and

Internet connection in years 2005-2013 in the regencies were also identified. Locational aspects and identification of regencies also occurred. Highland, middle centre (between highland and coastal districts) and coastal locations (North Coast and south Coast), were identified.

Those in the survey sample across the topographical locations included those from the following pairs of regencies:

1. Remote/Highlands : Regencies of Deiyai and Lanny Jaya
2. Middle centers : Regencies of Jayapura and Keerom
3. North Coast : Regencies of Nabire and Supiori
4. South Coast : Regencies of Merauke and Boven Digoel

Each area was represented by two adjacent regencies to ensure that if there were insufficient schools meeting the sample requirements in the first regency, a sample could be established in the second regency.

Urban, peri-urban and remote locations were encompassed in each of the identified regencies.

In the second stage, consideration was given about the cost of reaching the areas and visiting the schools. Hard-to-reach districts were underrepresented in the sample as compared to the population at large. Some districts within regencies which were of particular interest or those which were easier to reach were given higher selection probabilities prior to sampling. These districts were overrepresented in the sample. For example, the Regencies of Deiyai and Lanny Jaya are the representatives of Remote/Highland districts. The consideration here is that Lanny Jaya was provided with TV-E receivers in 2011 and the recent Governor of Papua has an agenda that is called “Gerbangmas Papua” that intensively manages education in five regencies. Among these regencies are Deiyai and Lanny Jaya. The access to those districts is relatively straightforward and safe compared to some other highland districts.

The middle center districts are represented by the Regency of Jayapura and Regency of Keerom. The consideration is that 29 and 31 TV-E package receivers respectively were provided in these regencies in the combined years of 2006, 2007, 2010 and 2011. Access to the capital of the Regency of Jayapura and Regency of Keerom is relatively straightforward and safe.

Northern coastal districts are represented by the Regency of Nabire and Regency of Supiori. Forty-two TV-E packages and 18 TV-E package receivers respectively were distributed in the combined years of 2006, 2007, 2010, and 2011. Southern coastal districts are represented by the Regency of Merauke and Regency of Boven Digoel, with 61 and 28 TV-E package receivers respectively being distributed in the combined years of 2006, 2007, 2010, and 2011. Merauke and Boven Digoel are considered safe and there are direct flights from Jayapura.

In all of these regencies, ICT Centres consisting of ‘lead’ schools and connected schools were also established. Lead schools in Jayapura, Keerom, Nabire and Merauke are of particular interest to this evaluation, with each of these locations having at least one lead school and between two and fifteen connected schools.

2.1.2 Sample of schools within districts

In selecting school within the four paired regencies, the numbers of schools within the district were counted, considering SD and SMP and also whether the schools were private or public. The geographical type of the district (urban, peri-urban and remote) and status as ICT or non-ICT program schools were other considerations.

After considering school information available to the research team at that time, schools with large numbers of teachers and students were given a slightly higher probability of selection to ensure a sufficiently large sample of survey responses. Consultation occurred with education authorities as information on the numbers of teachers and students was not reliably available.

Two hundred and twenty schools were eventually selected through the sampling process, including 175 which received the ICT program materials, with 200 schools being identified in the Terms of Reference document as the minimal requirement for the evaluation. About 80% of the sample consists of ICT program schools. The sample reflects about 10% of schools in Papua.

Table 3 indicates the initial sample within the four paired regencies involved, across urban, peri-urban and remote locations, school type and whether ICT or non-ICT program schools.

Table 3: Initial sample of schools, by location type, school type and whether ICT or non ICT

	Location Type			School Type		Total	ICT/Non-ICT Type	
	Urban	Peri Urban	Remote	SD	SMP		ICT	Non-ICT
Kab. Jayapura	14	9	5	10	18	28	22	6
Kab. Keerom	15	12	4	19	12	31	25	6
Kab. Boven Digoel	8	4	0	7	5	12	10	2
Kab. Merauke	27	16	11	19	35	54	43	11
Kab. Supiori	7	6	5	12	6	18	14	4
Kab. Nabire	24	16	10	19	31	50	40	10
Kab. Deiyai	0	0	4	4	0	4	3	1
Kab. Lanny Jaya	9	11	3	14	9	23	18	5
TOTAL	104	74	42	104	116	220	175	45

Given concern about uncertainty of records regarding schools in Papua, replacement schools were designated in the sample frame for each regency, district location and type of school. Where participation could not be secured from the originally sampled school, a replacement school was provided which had the characteristics determining stratification (in this case school level, type and sector and also whether ICT program school or not). Given poor weather at the time of the survey, additional replacement schools were also identified from neighbouring regencies and for some contexts to approximate the 80%/20% ICT program/non-ICT program aspects of the sample. Appendix B provides details of the schools in the actual sample.

2.1.3 Sample of teachers and students within schools

The final stage of sampling involved establishing the sample of teachers and students within schools. Upon arrival in the school to commence the survey, enumerators undertook a random sample of 15 teachers in each of the schools using the staff roster (of those present at school on the day) and using a random sampling table according to total numbers of teachers to develop the sample. Similarly, the student sample was drawn considering the student list of year 5 and 6 students (and their presence in the school on the survey day) or the list of year 7-9s. Where schools had less than 15 teachers or less than 15 students of the designated year levels, fewer teachers and students were included in the sample.

2.2 Development of data instruments

2.2.1 Survey

Five survey instruments were devised. Initially, one survey for ICT program school principals and another one for non-ICT principals were devised. Similarly, a survey for teachers in ICT program schools and one for non-ICT program schools were devised. A single survey for students (in both ICT and on-ICT programs schools) was developed. A field guide and training manual for training of the survey field teams and also providing training in preparation for interviews, were other documents developed.

The surveys for principals and teachers in ICT program and non-ICT program contexts included common questions seeking demographic data, and information about the access to and the use of ICT in teaching and learning and in school administration. These common questions were grouped under headings in regard to:

- Types of ICT Programs
- Use of ICT Programs
- Usefulness of ICT Programs
- Usefulness of ICT Professional Development Programs
- Attitudes Towards Using ICT
- Supports and Barriers to ICT Use
- Capability in Using ICT
- ICT Equipment and Activities at School
- Frequency of Use of ICT at School
- School Policies
- Specific Use of ICT at School
- Use of ICT Software at School
- Use of ICT at Home.

Principals of ICT and non-ICT program schools were also asked questions about ICT funding and ICT planning. For ICT program schools, questions included those which sought information about hardware provided by ICT programs and whether these items were in working order. All principals from ICT and non-ICT program schools were asked to respond to some survey questions linked to Papua's strategic directions for the ICT in education program and their perspectives about whether there had been improvements in aspects such as infrastructure, equipment, connectivity, resources and professional learning.

Students from both ICT and non-ICT program schools were asked identical questions. These questions were focused on attitudes towards school and ICT; access and frequency of use of ICT at school; other ICT being used by students; where computers are used; and

the frequency of that use. Another question was asked about any other ICT that students would like to use for learning at school.

The questions asked in each of the surveys piloted, included closed responses (e.g. yes/no); and 4 or 5 point Likert ⁵ scale responses such as 'strongly agree', 'agree', 'neutral', 'disagree' to 'strongly disagree'. There were also questions about the frequency of use of specific types of ICT, ranging from 'daily', to '2-3 times a week', to 'monthly', to 'not very often' or 'never'. Some open response questions were also included in each survey.

The second stage involved trialling the instruments in conditions as close to those that could be expected in the field and trialling of the training manual and field guide.

The third stage incorporated modifications and additions based on the results in the field trial to improve the instruments, as well incorporating the feedback from external reviewers. Final approval for all instruments was sought from the ACDP Secretariat prior to implementation in the field.

Following pilot testing only three surveys were used, one being for principals, one being for teachers and one for students. Instructions were provided for respondents to answer particular questions dependent on their contexts and response to other questions. An updated training manual and field guide were developed for the main study implementation.

Appendix C provides details of the survey instruments implemented in the main study.

2.2.2 Interviews and focus groups

To obtain more in-depth information about ICT in education in Papua, interviews and focus group questions were developed to seek responses from 12 schools across four regencies, including from two ICT program schools and one non-ICT program school in each of the identified regencies. Questions for semi structured interviews and focus groups involving principals, teachers, students and parents/community, were devised.

Open-ended questions for teachers and principals included those concerning teaching and learning using ICT; professional development and ICT; and challenges and opportunities. Additional questions for principals included those regarding ICT and administration, and others in regard to infrastructure challenges and successful strategies used.

Open-ended questions for students were about ICT at school and connections to learning, challenges of ICT at school, and student views about whether schools can be improved by using ICT for learning.

Questions for parent/community focus groups included both open response and Likert ² scale questions. ICT at school and links to learning, ICT at home, and other information that parents wished to provide about ICT and learning, were the main question categories.

⁵ A Likert scale is used in surveys and questionnaires to seek respondents' level of agreement or disagreement to various statements. The scale involves a gradation of options e.g. strongly agree, agree, neutral, disagree, strongly disagree aspects. The range is intended to capture the intensity of feelings for a given statement.

2.2.3 Piloting

The pilot study for the *Evaluation of ICT in Education in Papua* was conducted in four schools in the municipality of Jayapura and surrounds, between November 10 and November 14, 2014. The locations were selected as representative of the topographical/geographical contexts in Papua: i.e. urban, peri-urban and remote. These geographical contexts are consistent with those being covered in the main study. The locations for the pilot study were also chosen for their ease of reach from Jayapura. Intensive training processes were implemented during the lead up to the study to prepare those members of the project team and also district coordinators who were acting as the enumerators. The locations were selected as representative of the topographical/geographical contexts in Papua: i.e. urban, peri-urban and remote, also being consistent with those being surveyed in the main study. Three schools were ICT program schools and one school was a non-ICT program school. SD and SMP schools were accessed for the pilot.

The goal of the pilot was to test the survey and interview instruments, procedures and processes which had been designed for use in the main study. The data collection instruments had previously been reviewed by several researchers external to the project team members, including a reviewer from the Australian Council for Educational Research (ACER) and another reviewer from ACDP who has knowledge of the Indonesian/Papuan context. There was also ongoing review occurring by the project team.

Replicating the main study, a Letter of Introduction from the provincial officials and also an information sheet were provided, with a consent form being signed by the participant indicating agreement. A photo of the principal and school sign was taken.

On receipt of the completed survey forms, the pilot data was entered into an Excel spreadsheet and preliminary analysis undertaken. This data collation process aimed to replicate the processes intended for the main study. Similarly for the interviews and focus groups, digital recording of the process occurred, with consent, and also manual note taking. Uploading of the digital recording, verbal debriefing about key points and development of a written summary occurred.

Following the pilot, various amendments were made to the data collection tools and processes including establishing only three surveys. Principals and teachers at ICT and non ICT program schools would undertake the same survey as relevant to their role in the school and with instructions for respondents to answer or not answer particular questions dependent on their previous responses.

Interview and focus groups questions were trialled but only finalised after the main survey data preliminary analysis occurred. Appendix C provides all data instruments.

2.2.4 External review of instruments

The data instruments were reviewed by Australian Council for Educational Research survey specialists prior to the pilot process.

Additionally, throughout the pilot processes, the project team worked collaboratively with Pak Muhammad Yusuf from ACDP (Papua) and also Pak Albert Lantang and Pak Stanley Sumeisey from Dinas Pendidikan Pendidikan in Papua. These officials were part of the ongoing review and professional learning processes with the project team. Their involvement included confirming details regarding the sample of schools, attendance at the training

sessions and data gathering visits during the pilot. They provided an external perspective in the data instrument review processes.

A debrief session was conducted at the conclusion of the pilot process, with workshops such as this being a critical part of the ongoing processes. The debrief session included the external reviewers, as well as other ACDP representatives, members of the project team and several representatives from pilot schools. Discussion at the debrief session included a focus on the importance of the evaluation in shaping ICT implementation for the future, especially in terms of supporting active learning pedagogies and more individualised learning processes within the new curricula in Papua.

2.3 Field operations

2.3.1 Recruitment of survey field teams

The first step in field operations involved the recruitment and training of district coordinators as supervisors for enumerators who were subsequently trained and employed to collect the survey data. The field teams consisted of district coordinators, enumerators and data entry staff.

The Australian Council for Educational Research (ACER) and University of Sunshine Coast (USC) international team members, reflecting roles of team leader and technical coordinator respectively, were responsible for working with national project team members from a university who were employed through Willi Toisuta and Associates (WTA). Project team members were selected for their specialist skills. For example the project team leader had considerable experience in developing ICT capacity and in leading development consultancies as well as in report writing. The technical coordinator had skills in survey development and analysis. National project team member skills were in Indonesian educational policy writing and in quantitative research. ACER, USC and the national project team members visited Papua regularly throughout the research process and maintained regular contact via skype, email and telephone throughout the project.

The WTA employed the national project team members and district coordinators, as well as recruiting 44 individuals to be assigned enumerator roles. The district coordinators were responsible for managing and overseeing the field data collection in the four paired regencies and various districts involved in the study. District coordinators had a range of backgrounds and came from several different institutions which included universities and schools. District coordinators all had at least a university educational background and were generally experienced in the operation of educational research activities. Most district coordinators resided near the sampled regencies and districts that they were responsible for. District coordinators had responsibility for one or two regencies, with two of them overseeing a pair of regencies and with three of them overseeing one regency each, particularly in those regencies which had more hard to reach and isolated locations.

The enumerators and data entry staff were selected by WTA. A total of 44 enumerators and 6 data entry staff were recruited, with processes overseen by a national member of the project team. Most enumerators were located in the sampled areas and were graduates in educational or other relevant fields and had some experience in survey and research activities, with their ongoing employment being as teachers, university academics and government employees.

Data entry staff was responsible for entering the data in the data collection program which was a specially devised tool created by the national project team.

A summary of the staff allocation to various regencies for the field work is provided in Table 4.

Table 4: Fieldwork staff allocation

Regency	Team	Urban	Peri-urban	Remote
Lanny Jaya 6 enumerators + 1 district coordinator	3 teams	10 schools	8 schools	5 schools
Nabire & Deiyai 12 enumerators + 1 district coordinator	6 teams	23 schools 0 schools	17 schools 0 schools	10 schools 4 schools
Supiori 4 enumerators + 1 district coordinator	2 teams	6 schools	8 schools	4 schools
Merauke & Boven Digoel 12 enumerators + 1 district coordinator	6 teams	27 schools 4 schools	14 schools 8 schools	13 schools 2 schools
Keerom 8 enumerators + 1 district coordinator	4 teams	24 schools	3 schools	4 schools
Jayapura 6 enumerators + 1 district coordinator	3 teams	16 schools	11 schools	1 schools

District coordinators and project team members were responsible for the implementation of interviews and focus groups and also for the case studies, with these research processes occurring after survey data collation and preliminary analysis.

2.3.2 Field team training, training manual and field guide

Following the recruitment of the district coordinators and project team, training commenced prior to the pilot study, with survey materials and processes being amended after this. Similarly, following the enumerator recruitment, further training was undertaken at all levels of the project to ensure quality control and a detailed understanding of the project amongst all project staff. Prior to the main survey being conducted, a three day training event was

held in Jayapura, the capital of Papua, with the instruments being introduced and the processes for data collection and collation. A Training Manual and a Field Guide were used as the basis of the training.

The Field Guide included day-to-day operational aspects such as administration, roles and responsibilities of various people involved in the study, and checklists to support the carrying out of these duties. For example, for the District Coordinators, the Field Guide outlined their responsibilities for a team of enumerators who collect the survey data from a group of schools and then forward this for checking by the supervising District Coordinator.

The Training Manual included introductions to various teams; getting to know you activities; location for data collection and timelines; introductions to various surveys and data collation processes. Interviews and other wider aspects of the project are also introduced. Routines for school visits and role play practice activities were part of the Training Manual, including involving school students in the practice sessions.

2.4 Main data collection and collation

2.4.1 Surveys

Main survey data collection began simultaneously across Papua following the main study training. The enumerator field teams worked according to the data collection field guide. Teams of two enumerators shared the tasks of surveying the principals, teachers and students. Written consent and permission for photographs was sought at the time of survey completion.

District coordinators had responsibility for providing all survey instruments and stationery to their teams during data collection in the field. Before enumerators visited schools, district coordinators had made contact with principals to obtain school details. Districts coordinators then provided enumerators with the relevant list of sampled schools by name and address, region, district and school codes, as well as random number tables for the sampling of teachers and students. District coordinators maintained regular contact with enumerators throughout the data collection process. When completed surveys were received by the district coordinators from the enumerators, they checked the surveys to ensure full completion. If surveys were incomplete, the relevant enumerator was required to contact the school for further information before central data collation.

Data entry staff was responsible for the entry of data collected by enumerators using the specially prepared data collation tool. Data from the field was checked by the district coordinator and then photocopied and forwarded by courier or air to the central Jayapura location where the data collators were located. The district coordinators checked surveys for missing data and enumerators were required to contact schools when essential data was missing. The original surveys were hand delivered by the district coordinators to the central data entry location in Jayapura. The data entry supervisor and the overall field supervisor oversaw the data processes and rechecked that all required fields were completed in the surveys. It should be noted that because not all schools were involved in all aspects of the ICT program and some schools were non ICT program schools, that not all questions were required to be answered by all respondents.

As outlined in Appendix D, the data entry process involved a data collator entering the data and the data entry supervisor checking the accuracy. These data were reviewed by the field supervisor and centrally-located data specialists and cleaned, with queries then directed back to the data entry staff where responses were not clear, with data then being refreshed.

Data was uploaded to the server regularly. The project team regularly accessed the data and began preliminary analysis.

Contact with school principals occurred to recheck some data. Additionally, a short telephone survey with principals was conducted to gain information about current ICT hardware in schools such as computers, laptops, tablets, LCDs and televisions.

2.4.2 Interviews and focus groups

In addition to the collection of data from schools, the field team also collected qualitative data from Jayapura provincial officers and from district level Dinas Pendidikan officials, key staff at the KPGs and universities, as well as telecommunications leaders. District coordinators and project team members were responsible for interviewing the relevant officials on these occasions. Twelve schools were also selected across four regencies for focus groups and interviews with principals, teachers, students and parents/community. Selection occurred after the surveys. Selection of regencies and schools was based on responses to the surveys. Following school selection, individual teachers and students were selected because of interesting or detailed responses provided. Two ICT program schools and one non-ICT program school were selected in each of the four regencies involved. Consent forms were signed. Digital recording and manual note taking were activities undertaken to record information provided.

2.4.3 Case studies

Simultaneous with the pilot study and main data collection, some initial case studies were undertaken, with further case studies occurring at later stages of the evaluation. Case studies of successful implementations of ICT in education and 'good' teaching practices were prepared in four regencies that were acknowledged for their success by local authorities such as Keerom, Merauke, Jayapura and Nabire. In each of these school regencies, the regional education office staff involved in the administration and support of the schools was contacted and various successful schools or organisations were discussed. In addition, schools, interviews occurred with leaders of telecommunications and other organisations of interest. A case study was then prepared for each of the four locations (Appendix E: Merauke, Jayapura, Nabire, Keerom case studies). The purpose of the case studies was to enable the project team to extract and compare factors that indicate the principles of successful teaching practices and ICT implementation. This enabled the project team to develop a set of principles for the successful implementation of ICT in schools in order to identify potential indicators for future successful teaching and learning with technologies.

2.5 Data analysis

Following excel spreadsheet collation of the survey results, SPSS was applied by the project team for more detailed analysis of key questions. In the data analysis process, the specially-devised data collation tool was enhanced to provide more detailed information for specific categories of survey respondents such as examining principal and teacher survey responses by gender, age, urban/peri-urban/remote location. The tool also enabled student responses to be analysed by class, gender and regency and degree of remoteness.

Appendix F provides key survey facts, with more information and some analysis presented throughout this report. Appendix G provides detailed tables for some questions, again with some analysis presented in this report as relevant.

Possible correlations were examined by the statistical experts in the national project team using Pearson's correlation analysis. No meaningful information was obtained.

For the interview/focus groups and case studies, analysis involved examining summary updates of each interview and transcribing selected comments from the digital recording, plus verbal project team debriefing to identify key themes. Manual coding of key themes also occurred. As previously indicated, Appendix E provides case study details.

2.6 Achieved sample of survey schools

The survey was essentially conducted during the month of February 2015, with some research work continuing into March 2015 because of poor weather conditions and access issues. Survey data were collected from 220 principals, 1505 teachers and 3127 students. There were 220 schools in the final survey sample.

Table 5 provides details of the achieved sample of 220 schools across the eight regencies, with 110 urban, 67 peri-urban and 43 remote schools involved. Replacements were used due to unfavourable weather preventing the originally sampled school being reached and causing issues of safety for the enumeration teams charged with conducting the visit. Some schools were found not to have existed and these were replaced.

Table 5: Achieved sample by location, schooling level, ICT/non ICT categories

Region	Urban	Peri Urban	Remote	Total	SD	SMP	ICT	NON ICT
Jayapura	16	11	1	28	8	20	25	3
Keerom	24	3	4	31	21	10	25	6
Boven Digoel	4	6	2	12	5	7	12	0
Merauke	27	14	13	54	22	32	43	11
Supiori	6	8	4	18	13	5	9	9
Nabire	23	17	10	50	23	27	41	9
Deiyai	0	0	4	4	4	0	4	0
Lanny Jaya	10	8	5	23	11	12	11	12

Figure 1 depicts the geographical locations of the achieved sample schools in the eight regencies.

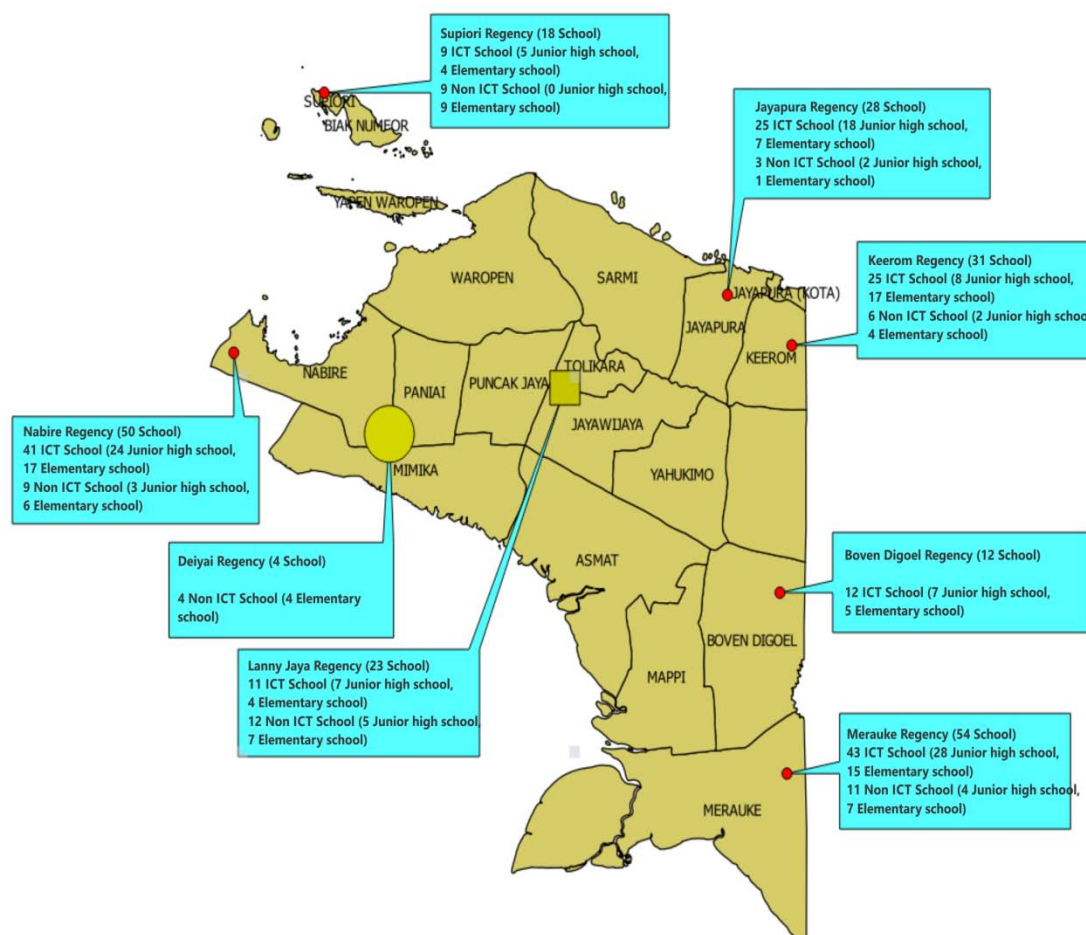


Figure 1. Location of achieved sample schools for survey

Appendix B provides a list of schools in the achieved sample and their details.

2.7 Survey participant demographics

2.7.1 Principal and teacher survey participant details.

Table 6 provides some information about the 220 principal survey participant demographics, with more detail outlined in Appendix H.

Table 6: Details of principal survey participants

		No. of Principals SD Total =107	%	No. of Principals SMP N=113	%
Gender	Male	93	81.57%	91	81.25%
	Female	21	18.75%	21	18.75%
	Yrs in position	No. of Principals		No. of Principals	
	0-5	39	36.44%	24	21.62%
	6-10	17	15.88%	24	21.62%
	11-15	21	19.62%	27	24.32%
	Yrs. using ICT for Admin	No. of Principals		No. of Principals	
	0	44	41.12%	18	16.07%
	1-3	19	17.75%	13	11.60%
	4-6	19	17.75%	31	27.67%
	Yrs. using ICT for Teaching	No. of Principals		No. of Principals	
	0	71	66.35%	48	42.85%

The number of years of principal survey participants in their current position is interesting, especially for the SD principals where over 30% are in their first five years. Of further interest is that over 40% of SD principals are indicating zero years of using ICT for administration and over 65% are identifying zero years of use of ICT for teaching and learning. Over 40% of SMP principals are indicating a minimum number of years of ICT being used for teaching and learning.

Table 7 provides some details about 1505 SD and SMP teachers, with further information in Appendix H.

Table 7: Details of teacher survey participants

		No. of Teachers SD N=613	%	No. of Teachers SMP N=892	%
Gender	Male	377	61.50	520	58.29%
	Female	236	38.49	372	41.70%
	Yrs in position	No. of Teachers		No. of Teachers	
	0-5	256	41.76	367	42.42%
	6-10	131	21.37	265	30.63%
	11-15	113	18.43	108	12.48%
	Yrs. using ICT for Admin	No. of Teachers		No. of Teachers	
	0	255	41.59	243	27.24%
	1-3	91	14.84	190	21.30%
	4-6	117	19.08	213	23.87%
	Yrs. using ICT for Teaching	No. of Teachers SD		No. of Teachers SMP	
	0	459	74.87	448	50.22%
	1-3	80	13.05	203	22.75%
	4-6	54	8.80	144	16.14%

Of particular interest is that over 40% of SD teachers are in the first five years of teaching in their current position. Similarly for SD and SMP teachers, there is little long term use of ICT for teaching and learning. Approximately 74% and 50% of respondents respectively are in the first five years of using ICT for the classroom.

2.7.2 Student survey participants

The 3127 survey student details are as shown in Table 8, with about half of the respondents being SD and half being SMP. Students are generally in year 5 and 6 or year 7-9.

Table 8: Student survey demographics

No. of schools =220, SD 107, SMP 113

Age	Nos.	Gender	No.	Class	No.
16	105	Male	1675	Year 9	570
15	341	Female	1452	Year 8	538
14	520			Year 7	551
13	523	Level of school	No.	Year 6	742
12	668	SD	1466	Year 5	685
10	265	SMP	1659	Year 4	39

2.7.3 School interview and focus group participants

School Interview/FGD sample numbers for the regencies of Jayapura, Keerom, Merauke and Nabire are outlined in Table 9:

Table 9: Interview and FGD participants in schools

Total numbers of participants across 2 ICT/1 non-ICT schools	Jayapura	Keerom	Merauke	Nabire
Principals/Deputies/Lead ICT	3	3	3	6
Teachers	18	18	15	30
Students	18	18	24	27
Parents/community	9	8	5	15

Additional officials representing two universities and two KPGs, also from six Dinas Pendidikan offices across six regencies, from telecom authorities, from training organisations and BPP, were interviewed.

2.8 Independent review of processes

During the data analysis processes, advice was sought from independent experts about technical aspects. The final report and recommendations have also been examined by an independent ICT expert to ensure quality of the report and appropriateness of the recommendation.

2.9 Summary

This chapter has outlined the research methodology for the evaluation including the surveys of principals, teachers and students in 220 schools. The interviews and focus groups in twelve schools, case studies and other interviews with key persons in a range of locations outside of schools have been introduced. The demographic profile of survey participants and some information about participants of the school focus groups and interviews has also been provided.

Of particular note regarding the survey demographics is the fact that SD principals are predominantly new to their current position. SD and SMP principals have only a few years of experience in using ICT for teaching (this also applies to SD principals for administration). SD and SMP teachers are predominantly newcomers to their current positions and the teacher group is relatively new to using ICT for administration and for teaching.

Chapter 3: Telecommunications and other Infrastructure in Papua

This chapter describes the geographical availability and reach of ICT infrastructure in Papua and the penetration of broadcast/internet and mobile phone services. These are aspects impinging on the potential effectiveness of ICT in education.

This chapter specifically addresses the first research question about the penetration of broadcast television (FM), Internet services (PSTN, ADSL, LEOS & MEOS) and mobile/cell phone services (GSM) and about the infrastructure which was intended for TV-E and the other ICT programs. This chapter also addresses in an initial way some of the research area two ICT infrastructure implementation issues.

From the initial assessment outlined here, including immediate future telecommunications work underway, and innovative telecommunications approaches for remote contexts, the groundwork is laid for policy recommendations relevant to various contexts as outlined later in this report.

3.1 Introducing Papuan telecommunications infrastructure

Papua province is at the extreme eastern end of the Indonesian archipelago. It has a population of about 3.5 million people, from an overall approximate Indonesian population of 250 million. Remoteness within Indonesia and a population of less than 2% of the entire archipelago has made it difficult for communications infrastructure in Papua to be developed at the same rate as elsewhere. Telephone and internet services are especially problematic in the more remote locations. Given the dispersed nature of the Papuan population, often in very mountainous locations without road or electricity networks, there are high costs involved in the provision of telecommunications. Many citizens live in areas that are sometimes days away from the nearest community (Sparrow & Vothknecht, 2011).

Currently, Papua is highly dependent on satellites in many aspects of telecommunications. Satellites are the infrastructure for long distance telephones, with the fixed public switched telephone network (PSTN) relaying telephone calls from land line telephones to an earth station where they are transmitted to other satellites. In Papua, fixed line telephones are only available in larger centres and there are less than 75,000 users. Mobile phones now dominate and involve over 1 million users (The World Bank, 2010; Kushnick, 2013). The most remote locations have no satellites or ongoing power, relying on occasional use of generators for some electrification and some basic radio communications.

Telkom transmission capacity for Papua as a whole is 20 Mbps (compared to the OECD residential average of 8 Mbps), with many parts of the Province being worse than this. Additionally, slow data speeds for the internet and poor quality transmission occur. ADSL or Asymmetric Digital Subscriber Lines are available in some parts of Papua, using copper telephone lines for faster transmissions and using frequencies not used by voice telephone calls although being distributed over shorter distance from the telephone exchange of usually less than 4 kilometres (Stallings, n.d). There are high costs involved even in coastal areas, with VSAT the most expensive but highest quality Internet access ranging in price from \$500-900 monthly (The World Bank, 2010).

However, only a few hours from these coastal and district locations, with telephone and internet lacking, students and the schools are unable to connect. In many of these locations, electrical power is only available when generated through micro-hydroelectric or diesel generators. Due to the poor power infrastructure and unavailability of satellites in many locations in Papua, communications for schools in remote areas is limited to Single Side Band radio which is similar to that used by amateur radio enthusiasts (The World Bank, 2010).

3.2 Satellites, TV and radio communications in Papua

Although not generally available in all remote locations, satellites are the backbone of the communication infrastructure in Papua especially in the capital cities and large regional locations. Communication satellites consist of transponders, antenna and switching systems, as well as Station Keeping Tracking which keep the satellites in the appropriate orbit, and also keep the antennas pointed in the right direction and power systems (solar cells and batteries) pointed to the sun. There are also command and control subsystems which maintain communications with ground control stations and which monitor the satellite's performance. The bandwidth available from the satellites depends on transponders, with TV, internet and radio requiring different amounts of bandwidth for transmission (Provincial Video, nd)).

Low earth orbits or LEOs typically operate about 2000 kilometres above the earth's surface and are only visible for about 90 minutes and from within a radius of 1000 kilometres from the sub satellite point. So a large numbers of satellites are needed to maintain good connectivity. Medium earth orbit or MEO satellites, orbit between 8000 and 20,000 kilometres above the earth's surface and they are visible for 2-8 hours and have a larger coverage than LEO, although having a weaker signal. Multiple MEOs are needed to give continuous coverage (Shamin, 2013).

Television and radio generally use satellites and these are a prime option for telecommunicating in remote areas, including in education.⁶ Radio and TV broadcasting is provided by both public and private stations. The private stations focus mainly on the main urban centers, like Jayapura, while the public broadcasters like TVRI and RRI historically have provided the most extensive coverage.

Bodrogini's (2014) research in Papua indicates that TVRI covers approximately 24% of the area and about 1.5 million people which is about 68% of the overall population. There are 21 broadcast locations which transmit between 1 and 5000 watts of power, with over 84 staff involved.

The radio broadcasting through RRI is supplemented by about seven municipalities which have their own local radio stations which operate on FM and AM frequency. Stations include Jayapura city (ART, Pro 2, Cycloop, Baiturrahman, SQ, RRI), Biak Numfor (RRI Pro 1, RRI Pro 2, RRI Pro 3, Mercury, Perkasa), Yapen Waropen (RRI Pro 1, RRI Pro 2), Nabire (RRI Pro 1, RRI Pro 2, KISS, RKM, Prodika, Swameka, Angkasa), Timika (HMM, Rama, Ebenhaeser, RBM, Bumi, Mimika, Al Azhar, RRI), Merauke (RRI, Prita) and Jayawijaya (RRI, Insani). The coverage of FM radio transmitters is more or less limited to the radio horizon. The KM 15 2003 provides the official frequency plan for FM broadcasting in Papua. RRI also has AM transmitters that can provide a wider coverage area around the transmitter due to the different radio propagation characteristics. Coverage of up to a few hundred

⁶ See the purpose and use of TV-E provided by TVRI.

kilometers, in particular in the evening hours, can be expected, also at locations beyond the immediate radio horizon (Bodrogini, 2014).

3.3 Energy access in Papua Province

Beyond the telecommunications access issues in Papua Province (Indonesia), energy access continues to be problematic, both for schools and the general population. Modern energy services are crucial to human well-being and to a country's economic development; and yet globally over 1.3 billion people are without access to electricity (EFA, 2011:3). While many developed countries may be focused on domestic energy security or decarbonising their energy mix, many other countries are still seeking to secure enough energy to meet basic human needs. In developing countries, access to affordable and reliable energy services is fundamental to reducing poverty and improving health, increasing productivity, enhancing competitiveness and promoting economic growth (EFA, 2011:8).

In Indonesia, as many as 82 million people or 36% of the population do not have access to electricity and about 54% are still relying on traditional use of biomass for *cooking* (Indonesian statistics for 2009: 11). Perusahaan Listrik Negara, more commonly known as PLN Indonesia, highlighted in 2012 that Papua has a 30.4% electrification rate (The World Bank, 2010). Generally rural and remote areas households and schools depend on low capacity solar cells provided by local PLN or use generators for night time lighting.

About 78% of primary schools and 8% of secondary schools are situated in the highlands or more remote coastal areas, with many of them not having power available which makes the use of ICT for educational purposes difficult. There are areas where electricity is available for part of the day, and other locations rely on solar-power and hydro-electric power or diesel generators. None of these options are cost effective to supply and maintain after initial establishment costs (The World Bank, 2010).

3.4 Future telecommunication infrastructure in Papua Province

To significantly improve telecommunication services, the Government of Indonesia has been addressing the need for a national fiber optic backbone network aimed at connecting 440 regencies and municipalities in 33 provinces through using over-land and undersea cables. In late 2006, the Palapa Ring project was presented at the second Infrastructure Summit. The main backbone /Palapa Ring West linking all provincial capitals and few municipals, was subsequently built by competing operators in West Indonesia. The Palapa Ring East project, initially slower to implement given smaller populations, is now nearing completion after its commencement in 2013. The Palapa Ring East will replace satellite-based transmission with high-speed fiber optic backbone in some locations, thereby freeing satellites for use in other parts of Papua.

It is anticipated that during 2015, the East Palapa Ring fibre optic cabling infrastructure connecting Papua and West Papua to the rest of Indonesia via high speed submarine will be 'switched on'. The completion of the full Palapa Ring East project has potential benefits of expanding access, reducing cost, and improving reliability and effectiveness of communication in Papua and West Papua. It is expected that it will reduce overall transmission costs for telecommunication operators, thus creating incentives for further investment in more remote sites.

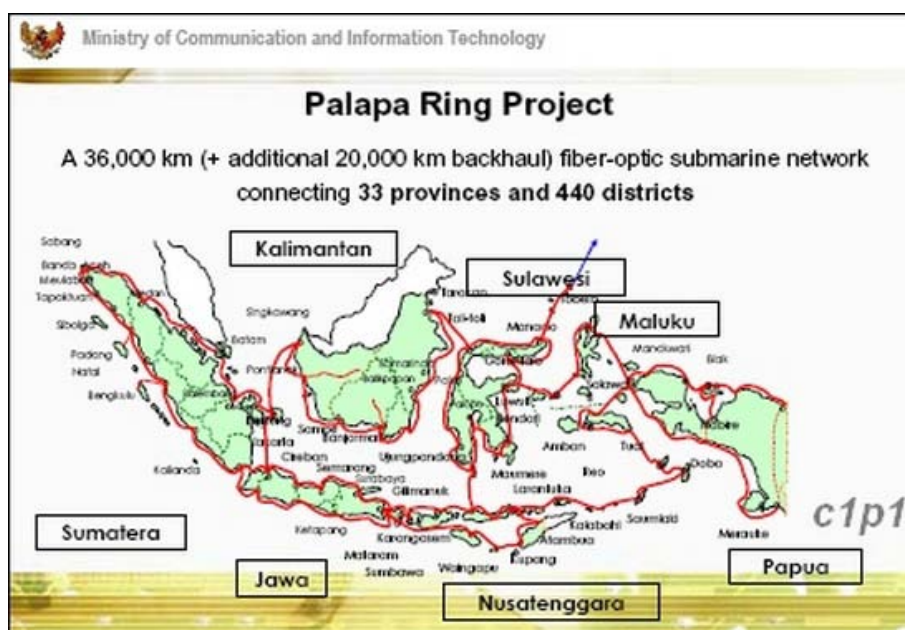


Figure 2. Palapa Ring backbone network

Access to fibre-optic is expected to initially be limited to the coastal urban communities of Supiori, Merauke, Jayapura, Sentani, Timika and Biak. This brings some benefits to the peri-urban areas around these conurbations as the satellite facilities in these locations will move out towards the peri-urban and remote areas. For example, Nabire, Deiyai and Lanny Jaya will not get the fibre optic cabling but will benefit because of the additional satellite facilities available for relocation to other areas.

As indicated, for those in the larger centres gaining fibre-optic, access to high speed Internet will be available at anticipated reduced costs. Mobile PLIK (Pusat Layanan Internet Kecamatan), a District Internet Service Centre providing Internet access to isolated districts will also move from the urban centres. A budget for this free service beyond mid-2015 is yet to be agreed. M-PLIK's supply objective is to serve district areas that do not have information access and internet. M-PLIK is a synergy KPU/USO program.

The urban areas are set to gain most when the fibre-optic is switched on. While this improved access will bring many benefits to an increased section of the population, e.g. high speed Internet (up to 100 Mbps), less congested mobile phone networks and fewer blank-outs. In the short term, the more remote areas may not see change or difference.



Figure 3. M-PLIK van in Merauke (Photo: John Hunt)

Research in this area undertaken for the purpose of this evaluation through interviews with relevant parties is suggesting that this does not have to remain the case. For example, in interviews held with developer and a field operative in Papua, discussions were held about an innovative ‘Telco in a Box’ solution currently being provided to a remote community in the Papuan highlands. Here up to 400 residents in a village have been connected to a mobile network (2.5G) via a ‘Telco in a box’. There are clear constraints on this at this stage as it is limited to voice calls and SMS. Access to 3G and 4G are presently in development and may be available by the end of 2015, with the Telco in a box infrastructure accommodating this without further costs and modifications being required.



Figure 4a and Figure 4b. Telco in a box

(Image source: Lumb, 2014)

This solution has a number of technical components: it requires an Endaga box (Endaga, 2015), a solar power bank and a VSAT link (provided by the local school). This solution operates as a *profitable* business. Shop owners sell ‘pulsa’ and receive a commission on sales, the school has its satellite charges paid (2.5 to 4 million Rupiah per month) and additional profits can be used to extend the network to communities as far as 100 kilometres away using sub stations and additional minimal cost Endaga boxes (line of sight is required as it harnesses microwave technology).

This community program has been running for several years and after the initial \$40,000 investment for solar power cells, satellite tower and also the current \$6,000 cost for the ‘telco in a box’, it is very low maintenance. Most maintenance, administration and updates are managed remotely by the software developers.

More importantly, this connection to the outside world has had important social benefits: professional members of the community (teachers and doctors etc.) can stay in contact with family and colleagues, and are thus more inclined to remain in these communities instead of seeking to return to other less remote areas.

3.5 Improving energy access in Papua Province

Beyond innovative approaches to telecommunications, ICT in schools can potentially be improved in the future through increasing energy access in Papua, with many locations currently having only having partial power access including through solar and hydro power.

In a report, *Infrastructure Strategies for Papua and West Papua (Infrastructure for Sustainable Development)*, (The World Bank, nd:8), the message is clear about infrastructure development that is effective and sustainable:

Well-functioning infrastructure development system should have the following components:

- *spatial planning based on topography, soil conditions, natural resource concentrations, and existing commercial networks and population concentrations;*
- *master-planning that coordinates various modes of infrastructure so that there is no unnecessary duplication and so that all components – transportation, power, communication, water and sanitation – are phased to be completed in a timely way for productive use;*
- *short and medium term planning that fits within the master plan and specifies intermediate targets each year for the next few years;*
- *feasibility analysis that compares specific options such as road alignment and type, alternative hydropower projects, and river port development so that options can be chosen that are technically feasible and satisfy financial and economic criteria;*
- *trained and experienced public employees at all levels of government who can carry out these tasks in coordination with one another.*

In Papua, there are very real challenges in relation to existing road networks and water supply systems being under-maintained, also power systems operating below capacity due to poor initial construction. For example, power supply in Papua is described as ‘unreliable; output is only 60% of installed capacity’ (The World Bank, nd: 8). The problem is that traditional grid electricity is problematic, a consequence of the geography of the province. Smaller grids are not cost effective, although very welcomed by remote communities but essentially reliant on ongoing subsidies. Public Private Partnerships (PPPs) may be considered, but there is a need to examine ‘incentivisation’, certainty and longevity of agreements to commit funds.

Some power solutions regarding solar, mini-hydro and other alternatives and their various advantages and disadvantages are considered in the next section of this report.

3.5.1 Solar power

There are a number of compelling reasons to explore solar opportunities: Papua is located in a remote, equatorial region with optimal access to the sun, and most resources for fuel and energy presently accessed exploits the environment and/or ecosystem, leading to future issues of environmental sustainability.

Access to solar power in the remote areas of Papua comes at significant cost and communities and/or suppliers have little potential to on-sell to the grid, making capital investment at times prohibitive. Whilst solar in developed countries has appeal, start-up costs and maintenance in Papua tend to be inhibiting factors for investors and governments. These start-up costs, with little or no return, make it very difficult to use the micro-financing schemes found in other countries such as in India and parts of Africa.

3.5.2 Mini-hydro power

Water-based renewable energy (hydroelectricity) has been available around the world for many years. It is one of the more cost-efficient means of generating renewable energy. Whilst in some areas of the world it creates considerable environmental angst (dams and impact on flora and fauna), a constant and natural flow of water can minimise such impact. Hydropower-based rural electrification in China has been relatively successful, with more than 45 000 small hydropower plants (SHPs) built. Many of these plants are connected to China's centralised electricity networks. This would be very complex and prohibitively expensive, if at all possible in Papua, leading to similar problems to those identified in regard to solar: that is, high start-up costs and little or no return (Energy for All, OECD/IEA, 2011).

3.5.3 Other alternative energy sources

Wind power is a well-recognised renewable energy resource involving the use of wind to turn turbines that generate electricity. This is a relatively cheap source of energy, with the building and maintaining of equipment providing jobs and clean electricity. For a range of reasons, wind farms are not always popular. They disturb local environment and wildlife and on a large scale and produce considerable noise. Wind turbines can be constructed in various sizes, from a turbine for a single house, up to turbines large enough to power a small village. Wind power requires almost constant wind and a quite large open space and this is a significant disadvantage in some locations.

Geothermal energy is extracted from the natural processes of the earth, usually in areas of known volcanic activity. Drilling and exploration are rather expensive. These plants require considerable space for the networks of pipes required to extract heat. Once a geothermal plant is established (at quite high costs), the ongoing costs are minimal (Energy for All, OECD/IEA, 2011).

3.5.4 A solution

Hybrid mini-grids, integrating several renewable energy options can be found in Thailand and are said to be working successfully. In Laos, a successful public- private partnership has been established to fund a hybrid (hydro, solar PV and diesel) mini-grid, serving around 100 rural households. In the project, public partners fund the capital assets (CSR), while a private local energy provider finances the operating costs.

If a successful model for a local energy provider could be found in Papua, this holds some potential for the future. Reliance on government funding may not work unless a sustainable and ongoing funding model can be established. The relatively successful mini-hydro program in Nepal, whilst faced with enormous start up costs supplied by public corporations, still required government funds to maintain the service, often up to 50% of operational costs (Energy for All, OECD/IEA, 2011)

3.5.5 Ways forward with improving energy in Papua

In summarising the alternatives for power improvement which may apply to the Papua situation, the following aspects need consideration:

1. Solar energy has high start up costs and panels/arrays have a limited life. There is ongoing maintenance required of batteries and related technical equipment. They

provide limited employment opportunity beyond installation and maintenance. Solar energy is green once the solar panels have been manufactured.

2. Geo-thermal energy is expensive to establish and requires vast tracts of land clearance for the necessary pipe infrastructure. There is high initial cost and high employment during construction. Road infrastructure is necessary to bring in large equipment and generators. Geo-thermal energy is a relatively green energy source.
3. Hydro-power has considerably high establishment costs, requiring road and communication infrastructure. At the same time, it creates enormous employment opportunities. It might be considered to be the energy that keeps on giving. The potential to create employment and ongoing revenue (through selling to a national grid) needs to be weighed against environmental and cultural losses.
4. Hybrid energy solutions require massive investment in infrastructure, including roads and communications.

Hybrid mini-grids, integrating several renewable energy options, has been suggested as a possible way forward for power in Papua, with benefits for communities and schools.

Beyond costs and environmental issues, cultural aspects need to be factored into decision-making around infrastructure, with various stakeholder groups involved in decision-making (The World Bank, nd).

3.6 Summary

This chapter has outlined the wider infrastructure challenges related to telecommunications and power in Papua which impact across communities and particularly impact on the quality of education and use of ICT in some peri-urban and in most remote schools.

The chapter highlights that currently, telephone, internet and power challenges exist across all parts of Papua to a greater or lesser extent, with the remote locations having no access to telephone or internet and limited access to power, especially during school hours.

During 2015, the Palapa Ring East fibre optic cable is expected to provide improved connectivity and speed for mobile phone and internet, with benefits including:

- For Jayapura, Merauke, Sarmi, Biak, Timika, Supiori, lower Internet charges and less congested mobile networks.
- For some areas outside the urban areas, anticipated improved access to phone and Internet services as mobile satellite facilities are relocated.

For remote areas, this chapter outlines the possible use of sustainable innovations such as 'Telco in a box' with its potential for bringing an increased connectedness to the rest of Papua and educational benefits from the use of ICT, together with associated social benefits.

Power challenges have also been introduced in this chapter with hybrid mini-grids, integrating several renewable energy options being suggested as a possible way forward for power in Papua.

The key issue for this evaluation and for improved education is that because of poor telecommunications infrastructure and lack of power in many locations, students are being disadvantaged in their education. While improved telecommunications through fibre optic cabling and relocation of existing satellites will support ICT in many urban and peri-urban schools, there is also a need to generate improved telecommunications and power

availability for remote communities. Through improved telecommunications and power provision to remote communities, access to ICT programs which benefit student and teacher learning can also be provided at the school level.

Chapter 4: Educational policies, organisational infrastructure and ICT programs

This chapter outlines the big picture policies and organisational arrangements for ICT participation at the national, provincial and regency/district levels. It provides further detail about policy, strategy and regulatory frameworks introduced in Chapter 1 regarding research area one and about the targeted ICT programs, infrastructure and implementation processes, including those involving links to universities and other wider bodies. The chapter also covers some aspects of research area two and questions about vision and implementation process, as well as providing new details about the targeted ICT programs.

4.1 Big picture Indonesian context for ICT

4.1.1 Ministry of Education edicts and plans

During the past decade, legislative and regulatory edicts have been used at the national level to signal the commitment of the Indonesian government and its directions in using technology to improve the education system and learning of teachers and students (Bodrogini, 2014). Documents include:

- UU Number 20 of 2003 on National Education System: Clause 1 verse 15, Clause 36 verse 3, Clause 35, verse 3.
- PP Number 19 of 2005 on National Education Standards, Clause 1.
- Permendiknas (Regulation of the Minister of National Education) Number 50 of 2007 on Education Management by Regional Government, attachment 1 & 2.
- Permendiknas Number 38 of 2008 on ICT Management in *National Education Department (Depdiknas)* environment which has been updated in Permendikbud (Regulation of the MoEC) No 99 tahun 2013.

Various strategic and other big picture plans at the national and provincial level have also been used in recent years, again highlighting the role of ICT in improving educational outcomes. For example the new MoEC leadership plan 2014-2019 focuses on the role for ICT in supporting governance, in quality assurance and in education access through digital learning systems, online supervision and governance support (Bodrogini, 2014 citing Kemdikbud, node 3552). The National RPJMN or Mid Term Strategic Plan in Education for 2015-2019, with the Human Development area, outlines the role of ICT in education in enhancing capacity-building, in strengthening effective learning methods and in educational management and learning resources provision (Bodrogini, 2014 citing Isu-isu Strategis RPJMN 2015-2019).

4.1.2 Other national education directions

Legislative frameworks and strategic plans provide the underpinning foundations for various national education directions impacting on schools such as *Curriculum 2013* and national online examinations.

Curriculum 2013 was introduced in recent years with a focus on more fully integrated approaches to curriculum, a reduction in subjects, and emphasis on civics, morals and creativity. Rather than ICT being a stand-alone subject, ICT across the curriculum was highlighted. The new curriculum was designed to shift the focus from traditional, teacher-centred curriculum to student centred inquiry. The pedagogical approach was about teachers facilitating the learning process, guided questions, expectations about students being more active and engaged in their learning and the development of critical thinking and communication skills (Nurcahyoko, 2013; Widarsa, 2013). While pilots have continued and there are some positive developments, there have also been significant issues such as lack of access to ICTs, hard copy new materials being unavailable and lack of teacher preparedness. There has been considerable dissatisfaction expressed about the removal of the ICT subject given a lack of readiness by all teachers for cross curriculum ICT integration, thereby causing a retreat to the 2006 curriculum (including re-introduction of the ICT subject) in most locations (Kennedy, 2013).

Another significant development involving ICT has been the introduction of online national examinations, originally intended for 2015. The shift from paper to online was premised on the belief that there was widespread availability of computers and the necessary infrastructure in schools in Indonesia. There were advantages expected such as more security and less cheating through technology, as well as considerable cost savings to be made through reductions in the expenses associated with printing of materials. However, while some ICT Centres for student examinations have been established and the process is being trialled, there have been delays in the large scale commencement because of lack of hardware and infrastructure, especially in locations such as Papua (Lukman, 2014).

4.1.3 ICT in Education Strategy and Implementation Plan for Education in Papua

Examining the Papuan ICT context in more detail, there have been various strategic plans in the past five years concentrated specifically on this province. For example, in 2010, the Ministry of National Education (now Ministry of Education and Culture) released the national *2010-2014 MoNE Strategic Plan* (Renstra) (Dikpora Papua, 2010). The plan outlined systems benefits afforded by ICT of enhancing educational access, quality, relevance, education, competitiveness, education governance, and educational accountability.

The plan confirmed an emphasis on infrastructure, online learning, online services (management, reporting and governance), professional learning and the establishment of ICT centres. The aim was to establish an ICT Centre in each district in order to provide Internet access to the district office and nearby schools, with schools being mostly connected by wireless.

The *ICT in Education Strategy and Implementation Plan for Education in Papua* (The World Bank, 2010), was similarly focused on goals of improved financial management; developing ICT competencies and capacity of principals, teachers, education office staff for administration and improved teaching and learning. Additionally, the plan highlighted the need for improving linkages between schools and district/regency offices; and also ensuring students have skills for living and working in an ICT world, including becoming more creative and independent learners.

Building on a previous provincial plan 2007-2011, there were four specific strategies in the *ICT in Education Strategy and Implementation Plan for Education in Papua* (The World Bank, 2010). These were:

- improving ICT infrastructure, connectivity, equipment (through establishing 60 ICT Centres in senior level schools as hubs with other connected senior schools; SD base

- schools accessing learning resources; establishing pilots for remote schools with limited connectivity and electricity);
- improving education systems monitoring and finance (through skilling relevant school and district office persons in simple spreadsheet reporting tools);
- enhancing capacity of education staff (related to maintenance of equipment, principal reporting skills, teacher teaching and learning skills), and
- developing and disseminating learning resources especially for remote schools through DIKPORA learning-resource development center (housed within DIKPORA Papua's *Balai Pengembangan Pendidikan* (BPP) building). This involved developing capacity for multicasting electronic content which can later be downloaded by schools.

4.2 ICT in education programs

During the decade of policy and strategic emphasis on ICT in education, various programs to improve education were initiated by the Indonesian and Papuan governments and these are a key focus for this evaluation. These programs include using television, radio and video and film to provide curriculum resources and professional learning to pre-service teacher education students and also to teachers through the provision of online resources. A number of interventions using ICT have occurred in Papuan schools and communities in the last decade and these have involved various partners in working together and seeking to improve the access of students and adults to opportunities for learning.

4.2.1 Pustekkom

A key ICT organisation in Indonesia has been the national education technology agency Pustekkom (Centre for Information and Communication Technology for Education), which was established in 1978 with the specific, expressed purpose of delivering educational content to schools. Based in Jakarta, Pustekkom was accountable to the Ministry of Education and Culture (MoEC). The initial focus for Pustekkom was on the provision of audio/radio and video/film/television content. In 2005 however, Pustekkom was given a wider brief to include a broader range of technologies in education. This brief was formalised in 2008 through the development of a mandate to plan and provide ICT infrastructure, services and professional development for education (Pustekkom, 2012).

Supporting these strategic planning directions at the national level, Pustekkom's changing role involving support for a wider range of technologies became increasingly evident in a restructured agency. Pustekkom organised itself into various main groups to implement the directions for ICT in education. There was a continuing focus on the delivery of content (radio, television and film) and also on aspects which were new to the organisation such as multimedia and web-based technologies for teaching and learning, and network/connectivity development. That is, Pustekkom became responsible for the delivery of online services for teaching and learning, as well as for the professional development of the teaching workforce. In this context, plans were developed in Papua for advancing the take up of ICT in education and its application within teaching and learning (Pustekkom, 2012).

Furthermore, Pustekkom was given responsibility for connecting schools via Jardiknas and School Net, both of which connected over 32,000 schools in 2011 (Pustekkom, 2012). As a result of concerns about the suitability of content however, all data was routed centrally through Jakarta, thereby eventually causing some issues because of the differing time zones across Indonesia and also due to varying cultural needs.

Within the Papuan context, various types of ICT through television or through computers and online services was potentially considered as having a significant role in improving

education, with different ICTs dependent on urban; suburban or remote locations. ICT was indicated as an enabler to accelerate educational development for formal and non-formal education at all levels. Modouw (2011) has indicated that this occurs through facilitating education and financial management, increasing capacity of staff, enhancing links between and within organisations, and nurturing student empowerment (Modouw, 2011).

Information about these programs which was previously introduced in Chapter 1 is now outlined in more detail, including in regard to the infrastructure required for the ICT program.

4.2.2 National and provincial government initiative: TV-E program

TV-Edukasi (Education) was a national program owned by the Ministry of Education and Culture (MoEC), with implementation and ICT coordination occurring through Pustekkom in collaboration with the Ministry and with local governments. The program was aimed to: a) support compulsory education implementation, b) provide educational services, particularly those in remote areas, c) cope with variety of educator qualification/quality challenges, d) provide quality learning materials, e) promote students' learning motivation, and f) distribute information on actual education policies.

TV-E was initially launched in 2004 and broadcasted through satellite, relayed by local and subscribed TV channels and with video streaming also available through the internet. TV-E had two channels with scope for local adaptation and specific broadcast composition for the channel's targeted viewers. Channel 1 was targeted for students of all levels, education practitioners and community. Composition of broadcast was specified as 10% information content, 20% non-formal content, 40% formal content, and 30% informal content. Channel 2 was targeted for all educators, Primary School Teacher Education (PGSD) students, education practitioners and community. Different from its counterpart, Channel 2's broadcast composition did not include non-formal content, but instead had about 10% information content, 50% formal content and 40% informal content.

In order to fully achieve TV-E's benefits, during the period between 2006-2007 and 2010, the Education Youth and Sport Office of Papua distributed TV-E equipment including TV, TVRO, generators, solar panels and DVD players to many SD and SMP/MTs (Madrasah Tsanawiyah) schools in Papua. In 2006, 2007 and 2010, TVs were initially distributed to 976 schools (490 SD and 486 SMP/MTs); TVROs were distributed to 586 schools (290 SD and 296 SMP/MTs); generators were distributed to 160 SMP/MTs, solar panels to 140 schools (90 SD and 50 SMP/MTs); and DVD players to 639 schools (290 SD and 349 SMP/MTs) (Perangkat TV-E, 2011). Further equipment items were distributed in 2011 to produce the totals identified in Table 10.

Table 10: TV-E packages distribution to Papuan schools

Year	2006	2007	2010	2011	Total
Schools	358 schools (SD, SMA, SMP/MTs)	637 schools (SD, SMA, SMP/MTs)	90 SD	48 SD 1 SMP 1 SMA	1,135
TV	486	400	90	50	1026
TV Receive-Only System	296	200	90	50	636
Generator	160	-	-	-	160
Solar Panel	50	-	90	50	190
DVD Player	349	200	90	50	689
Total ICT equipment distributed across about 1000 schools	1,341	800	360	200	2,701

(Source: ACDP 045 Terms of Reference document)

The number of packages provided to the eight regencies which are the focus of the current evaluation totaled 174 for SD and 185 for SMP (*Evaluation of ICT in Education in Papua*, Terms of Reference document).

In early 2012, monitoring visits in regard to the effectiveness of the TV-E program occurred, with varying results being indicated (Bodrogini, 2014). Some schools were using TV-E for teaching and learning and the equipment was maintained and intact. However, many other schools reported that the equipment was broken or unused. Concerns about the time zone differences between Jakarta and Papua were raised. On the basis of these issues, operation of the TV-E channels to Papua Province was suspended later in 2012.

4.2.2.1 Survey results regarding TV-E hardware

Regarding TV-E infrastructure, questions were asked of principals in the survey about whether their schools had received TV-E equipment from the government program (antenna etc), the year it as provided, whether all component parts were received and whether the equipment was still working or not. Table11 provides details of principal responses regarding some aspects.

Table11: Principal survey responses about TV-E equipment supplied

N=190

TV-E components	Provided Yes %	Provided No %	Don't know if provided %
Satellite dish/parabolic antenna	58.4%	22.6	18.9
Satellite decoder	41.0	33.5	25.5
Television	67.2	18.0	14.8
DVD player	54.5	25.7	19.8
Genset/solar/mini hydro	34.0	43.6	22.3

Table 11 indicates that various items of equipment were received including 34% of schools receiving genset/solar/minihydro and 58.4% of schools being supplied with a satellite dish/parabolic antenna. About half of these items are still working. Additionally, 67.2% of principals stated that they had received a television, with about three-quarters of them indicating the TVs were still functioning.

Almost 20% of principal respondents on most question items were indicating ‘don’t know’ responses regarding provision of various pieces of equipment and whether items which were still working.

4.2.3 Portal Rumah Belajar or m-edukasi

Portal Rumah Belajar (<http://belajar.kemdikbud.go.id>) or m-edukasi was developed by Balai Pengembangan Multimedia Pendidikan (BPMP) and Pustekkom. The process involved adapting some of the subject matter related content in TV-E for use on mobile devices. The Rumah Belajar portal for teachers and students enabled access to digital materials for teacher and learning purposes. A feature of Rumah Belajar was allowing teachers to establish a virtual classroom for e-learning. There were limitations with file size, with large files causing difficulties where cellular bandwidth is not strong, especially in non-urban areas. The use of the mobile devices is currently not supported by the Papuan Office of Education, Youth and Sport or by the Indonesian Department of Education and Culture.

4.2.4 School Net/Jardiknas

School Net/Jardiknas was a national program to connect schools to the Internet and a Wide Area Network. It particularly served as a primary means of communications between the Dinas Pendidikan and schools, as well as universities and other tertiary learning institutions. Jardiknas operated as an intranet and facilitated dissemination of some learning resources, also increasing access to Rumah Belajar materials. In 2013, about 300 basic (SD), junior secondary (SMP) and senior secondary schools (SMA) in Papua were linked through the School Net/Jardiknas connection. The site provided resources for learning and virtual classrooms for e-learning⁷, together with online professional development about curriculum for teachers (The World Bank, 2010). Decreasing connectivity was evident in recent years, with schools increasingly making their own internet purchase arrangements.

4.2.5 ICT for non-formal education and community learning centres

Through the issuance of the Papua Special Autonomy Law 9 (2001) and the ICT in Education *Strategy and Implementation Plan for Education in Papua* (The World Bank, 2010), the Papuan education office has supported the Badan Pemberdayaan Kampung (Village Empowerment Agency) to implement non-formal education activities to eradicate adult illiteracy. The purpose of the program was to use technologies to provide access to information for communities living in remote villages. Between 2010 and 2012, the program involved distribution of packages, similar to the TV-E equipment sets, to about 3,000 villages.

⁷ E-learning refers to the integration of digital technologies and digital materials with teaching and learning. The term includes online distance learning.

4.2.6 SEA Edu-Net

The SEA Edu-Net network across South East Asia was established for distance learning and data sharing among South East Asian teachers. It has operated as a resources repository for all subjects, involving teachers in sharing materials. More recently, Sea-Edu-Net 2.0 has been established as a virtual class platform for teachers, focused on supporting interactive communication and learning.

4.2.7 ICT Centres and other programs

Another ICT direction for Papua in the past decade has been ICT Centres. These were initially established in Jayapura, Keerom, Nabire and Merauke, with SMK schools in each location operating as the key centre and then with connected SD and SMP and other schools involved. About 44 schools were part of the ICT Centre project.

Since the ICT Centres were initiated, a variety of operational directions have been established in the regencies and districts. One particular example of ICT programs established in ICT Centres is the distance learning program in Keerom called the *Digital Learning for Teachers Professional Development program* or *Teacher Open Lesson* program. This was led by Universitas Pendidikan Indonesia (UPI) and Institut Teknologi Bandung (ITB), with funding from the Directorate General of Higher Education and Papua provincial government. This two year research program from 2009 to 2011 was a response to unique and challenging geographical and educational conditions in Papua, with ICT use expected to bridge the geographical distance in the teaching delivery. By leveraging ICT in the form of learning with digital media, it was hoped that the professionalism of primary school teachers could continue to grow in a sustainable manner toward local autonomy (Usul Penelitian Strategis Nasional Tahun Anggaran, 2010).

The digital learning program aimed at three goals: to develop digital learning; to accelerate government program through Teacher Education Institutions; and to increase capacity in delivering Teacher Education Program. This program was implemented as an ICT based lesson study and its objectives were to increase teachers' academic and professional qualifications without having them leaving their schools and students, also taking advantage of the learning community to sustain quality improvement.

Since its launching, ICT equipment and affordable connectivity were provided to six ICT Centres (SMA Negeri 1 Arso, SMK Negeri 1 Keerom, SMA YPKK Taruna Tegasa, SMA Pembangunan Yapis Skanto, SMP Negeri 1 Waris, and SMP Negeri 3 Yamamua, Arso Keerom) and to 60 connecting schools. The focus was on teaching skills in Mathematics and Science, with this program providing integrated training for teachers through face to face sessions, weekly distance learning sessions, and virtual class observations (Modouw, 2011). Face-to-face and web based or blended learning were the processes involved. As part of the program teachers had to use a pedagogy that applied discipline knowledge within real and practical contexts. Their practical sessions were video recorded and streamed to other teachers in other schools to provide opportunities for classroom observations and to elicit feedback and reflections on teaching practices (Modouw, 2011).

The challenges encountered were equipment maintenance and technical support for the schools. Additionally, the university tutors and facilitators were not able to provide on-demand and prompt support to teachers and schools for any technical difficulties. Trouble shooting was slow because of unavailability of local coordinators. These issues hampered the teaching and learning process and the sessions were often suspended. However, WVI (Wahana Visi Indonesia) which is based in Keerom and other parts of Papua, provided

support for teacher participants to continue their learning in their ICT Centres with better connectivity and equipment. Despite the technical challenges, the program's notable success was the adoption of the lesson approach by University of Cenderawasih Primary School Education Program Study (PGSD) as part as their distance education program (The World Bank, 2010).

Since 2013, further ICT in education initiatives have occurred at the district level, with nine Papuan districts being involved. Initiatives of relevance to the current evaluation include the computer purchases and connectivity provision for education in Nabire and the Literacy Training for Education Office Staff and Teachers in Merauke.

4.3 Provincial and regency policy contexts

The Papuan policy context is underpinned by the current Papua Education Development Strategy *Gerbang Mas Hasrat Papua* initiative which means Self-Sufficient and Prosperous Awakening Movement, the Hope of All Papuans. Together with its associated Education Roadmap, this document provides a five year program, 2013-2018, which is about accelerating development in health, education, local economic development and micro infrastructure. ICT is embedded without being explicitly specified as a mechanism to improve access to universal basic education and build human capacities. Community based pilots have been established addressing respective development priorities, e.g implementation of small primary schools and eradication of illiteracy especially regarding the five districts of Merauke, Boven Digoel, Keerom, Deiyai and Supiori.

The Papua Education Road Map is about ensuring that by 2018, Papua can complete the objectives of basic education for all Papuans; gender equality and women empowerment, and using ICT to improve access and education quality at all education levels.

While national level regulations seem to support Papua ICT in education programs at provincial level, specific technical regulations or formal guidelines which need to be aligned at provincial and district levels are not always evident. While most education officials and district educational staff acknowledge the importance of ICT use⁸, the programs need to be established using a systemic approach, with local strategies utilised towards ensuring sustained coordination.

4.3.1 Balai Pengembangan Pendidikan (BPP)

Balai Pengembangan Pendidikan (BPP), (loosely translated as the Education Development Body), is a unit of Dinas Pendidikan Dikpora of Papua Province. Its current role focuses on research, monitoring the national examination, also coordinating ICT in education programs in Papua province including provision of training. Another key role for BPP has been about supplying equipment, disseminating resources and monitoring the use of ICT in the teaching and learning process. These types of responsibilities of training and dissemination of print and web resources are consistent with the role for BPP as outlined in the *Implementation of ICT in Papua province 2010-2014* strategy. Evaluating and developing supporting materials, including developing capacity for multicasting electronic content for later downloading by schools, are viewed as increasing the quality and the effectiveness of these resources.

From 2007 until 2011, BPP distributed TV-Edukasi to the regencies and schools. Pustekkom was responsible for the National Training of Trainers in 2006 and 2007, which was continued

⁸ Based on pointer notes of Provincial ICT in Education Coordination Meeting in November 2012.

by the *Balai Pengembangan Pendidikan* or BPP (Education Development Center) of Papua Education Office, with training of a total of 1500 teachers occurring from 2008-2010. The training was focused on helping teachers to understand how to use TV. Schools receiving packages were expected to incorporate TV-E broadcasts or recorded programs into teaching and learning in the classrooms and into independent learning, either through homework or group work (Pustekom Depdiknas, 2007). With the intention of maximising learning achievement, teachers were required to follow a number of steps prior to, during and after usage including:

- i. Preparation: explore the curriculum and decide on when to incorporate TV-E programs into teaching and learning activities; match the session schedule with the broadcast schedule of the selected topic or record the content for asynchronous interaction; compose lesson plans and refer to the supplement books; and check equipment functions.
- ii. Actual Session: introduction; ensure students are actively interacting with the media; ensure that all students can hear the broadcast/recorded program; ensuring students' comprehension; and conclude the session.
- iii. Follow up: provide follow up explanation, prompt questions and discussion; follow up on students' tasks (e.g. worksheet completion); and enrich students' understanding with additional content.

Following initial TV-E promotion and coordination, given the two hour time difference between Jayapura and Jakarta, the distribution of CD/DVDs for education was carried out by BPP. Since 2012, TV-Edukasi's broadcasting has been suspended. Some interviewees from the evaluation indicated that TV-E was not successful due to insufficient monitoring by the Dinas Pendidikan and by provincial government officials and a lack of will by government to support maintenance. Theft of equipment even prior to installation was also indicated.

In more recent years, given its key coordination role across regencies, BPP staff has undertaken some coordination and distribution-of-materials roles, as well as professional development. For example, in 2012, BPP coordinated a meeting of nine district representatives to compose district/regency based ICT plans for the 2012-2013 timeframe. In regard to the regencies of relevance to this evaluation and involved in that meeting, these initiatives included all groups indicating the ICT integration of objectives into regency and district plans aligned with Renstra, as well as forming ICT coordination groups (Jayapura's School Operations Working Group); forming ICT Centres for data and teacher professional development centers (Keerom); undertaking computer purchase, improvement in electricity and internet connectivity provision for education (Nabire), and ICT Literacy Training for Education Office Staff and Teachers (Merauke/Nabire). Another goal was about integration model schools for ICT in Nabire and Merauke and to increase education governance of ICT, as well as increasing the number of school partners. At that time, Keerom had started model school/partnership initiatives as outlined previously and the district was beginning to share the work with other districts as an example of good practice.

BPP subsequently followed through on several of these coordination initiatives. BPP led coordination undertaken with Jayapura and Biak. In Jayapura, this led to the formation of the School Operators Working Group (KKOS) and there was a plan developed to provide financial assistance in the development of ICT infrastructure in 2015. In Biak, BPP assisted the local education office in the establishment of *Pusat Sumber Belajar* (PSB) or the Learning Resource Center, where multimedia-based learning resources have been utilized.

Despite these commitments, district level policies and guidelines do not appear to have been established in all participating districts. These policies and guidelines are needed to support effective utilisation in ICT. Such policies are likely to ensure continuation of ICT in education

programs. The case of Keerom reflects how absence of formal commitment leads to significant change of focus (Bodrogini, 2014).

While interviews indicate that BPP has tried to continue its coordination role, this has been compromised because there have been budget cuts in 2013 and 2014. Additionally, BPP has not been able to continue to produce digitalised learning resources on CDs.

BPP's focus for the forthcoming period is about professional learning involving 'train the trainer', with a budget being provided to supply ICT equipment and for ICT training. The interviewees for this evaluation indicated that the training will occur in two stages. First, training of the trainers will occur in Jayapura, with 25 persons attending each of the training sessions. Training for other teachers will then occur in their regencies, with each initial person trained being responsible for four other teachers and then repeating this process further.

4.3.2 Dinas Pendidikan

Considering other education institutions and infrastructure to support ICT programs, Dinas Pendidikan officials play a key role within the regencies. In seeking to evaluate the role of the Dinas Pendidikan in TV-E and other ICT programs there were various interviews conducted for this evaluation, with most of the Dinas Pendidikan officials involved. Many of the Dinas Pendidikan officials are newly established and did not have any understanding of the work previously undertaken by their offices in regard to TV-E and other programs which are the subject of the current evaluation.

Historical information which was obtained indicated that when the cross district/regency coordination workshop was held in 2012 through the efforts of BPP, despite commitments made, district level policies and guidelines were not established in all of the participating districts. Just like in Keerom, many of the initiatives in other regencies were not followed through because of changing regency/district directions, changes of personnel and limitations to budgets.

The current evaluation seeks to gain additional information about what was achieved and the role of the provincial government and various regency/district Dinas Pendidikan officials in supporting ICT directions and initiatives.

To gain an understanding of the work of the Dinas Pendidikan, interviews were conducted with Dinas Pendidikan officials in many of the regencies involved in this evaluation and with other training groups and some NGOs. Previous work undertaken and relevant to the ICT programs by BPP, districts and schools were explored. Current and future directions in regard to vision and implementation were also investigated.

Regarding TV-Es and the Dinas Pendidikan role in the past, it was unclear who made decisions about which schools received packages. Many Dinas Pendidikan officials indicated that they believed criteria had been used, although final decisions sometimes were made in Jakarta.

Regarding current work in ICT, most Dinas Pendidikan officials were indicating that they had a role in the following types of ICT activities:

- finding funding for ICT centres and equipment and undertaking an overall coordination role especially in regard to establishing national online exam centres for students by 2016;

- supporting some locations to be established for online testing for the regency in regard to teacher and principal competencies;
- supporting school operations working groups for IT;
- supporting teacher and principal PD groups and communities of practice;
- supporting online administration work, including sometimes distributing laptops to principals especially in remote locations, also providing a venue for remote principals whose schools were without power and internet such that they were provided with a location to do online administration and reporting tasks;
- coordinating and part funding Masters programs and supporting further study opportunities for teachers and principals, involving distance learning and thereby building ICT skills of those involved, and
- establishing ICT vision statements for their regencies and districts and then seeking alignment from the relevant schools. For example in one regency, there is a vision statement which *Recognises that ICT is important for teaching and learning access and connectivity are a prime concern.*

Future directions included coordinating PD for teachers in ICT especially in more remote locations and sometimes providing laptops for teachers and principals to meet ICT competencies. Alternatively, some regency leaders indicated they were giving teachers and principals the ICT equipment and time to build skills and then requiring them to demonstrate competencies.

4.4 Future provincial directions

4.4.1 Current provincial initiatives

A senior Papuan education leader has indicated in an interview that ICT is important for education and needs to be considered in the wider context of schools, formal, non-formal and informal learning. Synergy of planning, including with districts and schools, is required.

He emphasized that any ICT plans needs to consider infrastructure and human capacity and synergy, with planning going beyond the provision of equipment and also being about maintaining and repairing infrastructure and equipment.

Some key current directions are as follows:

- Integrated program of ICT is needed in schools, with links to a special governor's program.
- *Gerbang Mas Hasrat Papua* influences have established standard model schools in the districts as a pilot. Funding for about five districts for each of four years is focusing on some equipment but mainly on professional development (train the trainer), finance and management using ICT, also focused on synergy at the school, district, province level.
- Five districts in 2014 (Supiori, Keerom, Boven Digoel, Deiyai and Lanny Jaya) and five districts in 2015 (Sarmi, Waropen, Mappi, Puncak Jaya, and Tolikara), are involved.
- A school model for early childhood is occurring involving integration with small school classes (class1,2,3), and junior high such as in Lanny Jaya where two districts and three sub districts are operating, with each sub district having two early childhood, two SD, and one SMP institution working together.

4.4.2 Future directions

The interviewee indicated that the future educational vision is for student directed learning, with alignment needed between government, province, district and schools. Alignment is also needed with donor agencies to ensure outcomes are achieved, with commitment from all stakeholders being required. Currently, Papuan provincial education leaders are concerned that teachers are unaware of how to use ICT to improve learning but they also acknowledge that ICT is only a small part of the wider need for teacher development.

Education authorities indicate that help is needed for developing a proposal relevant to all levels for ICT capacity building of provincial, district and school personnel, working together with universities to provide support with teacher professional learning.

Education leaders recognise that evaluation of achievements is also important for the future and evaluation needs to be built into plans, including developing indicators of success. Guarantees are needed for mandated ICT access and to build understanding of the value of ICT for learning of teachers and students. There is also a need for responsibilities to be clearly outlined for teachers, districts, parents (school committee), and government.

4.5 Other educational supports

An important part of the infrastructure for ICT programs and supporting success has been the involvement of various non-government organisations (NGOs).

While a variety of NGOs are operating in Papua, one of the case studies for this evaluation included obtaining further detail about the role of the Wahana Visi Indonesia (WVI) in ICT programs. WVI, with financial aid from WVI Canada, supported Keerom in the *Digital Learning for Teachers Professional Development program*. WVI funded some building improvements in schools and also built towers for some schools, as well as subsidising intranet and internet at YPPK schools through VSAT, with Telkom as the provider. In the associated communities, eight *Taman Bacaan Pustaka* (social libraries) were also established relevant to VSAT. ICT training for teachers in Yayasan schools occurred. There were success stories but also issues especially with theft, and with schools being able to fund equipment maintenance costs. Many schools and users were unable to pay for the associated internet and VSAT charges of about Rp 2.5 million per user per month. From September 2015, the contract between WVI Keerom and WVI Canada will end and buildings, towers and the social library costs will become the responsibility of Yayasan schools. WVI interviewees raised considerable concerns about the capacity of Yayasan schools to meet these upcoming financial responsibilities for ICTs operating in the schools.

4.6 Summary

This chapter has focused on the context and ICT program implementation occurring at the provincial, district and school levels.

The ICT programs which are a key focus for this evaluation have been introduced in further detail and principal survey responses have been outlined about equipment provided as relevant to TV-Edukasi. For example:

- Responding principals indicated 34% receiving genset/solar/mini hydro and about 58% receiving a parabolic antenna, with about half of the items still working;

- 67.2% indicated receiving a television (with about three-quarters of principals indicating still working).

Various stakeholder roles have been outlined at school level, Dinas Pendidikan, provincial levels and universities in regard to equipment provision. Given significant changes to Dinas leadership, many questions about previous policies and implementation processes and decision making about ICT tools and which schools received various items were unable to be answered.

Professional development has been described including some innovative programs developed in partnership arrangements and involving virtual learning processes. However lack of ongoing resourcing and political will and lack appropriate infrastructure and alignment to ensure sustainability, have been outlined as issues.

Some of the key insights for future ICT are about the need for commitment and alignment of strategies between the national, provincial, regency/district and school levels, and also between sectors at the provincial level, to ensure sustainability of any future programs.

Chapter 5: Teaching and learning using ICT program materials

This chapter is about teaching and learning processes using the ICT program materials which are one of the foci for this evaluation including TV-Edukasi, Portal Rumah Belajar, SEA Edu-Net, Jardiknas/School Net and also non-formal education within Community Learning Centres. Teacher and principal surveys, interview/focus group responses and case study information have been used to gain an understanding of the types and frequency of use of these materials. Relevant to research area 2 and systems implementation regarding teaching and learning, the types of activities in which teachers and students have used the materials are outlined in this chapter and there is information about teacher and principal perceptions of ICT usefulness.

5.1 ICT programs in survey schools

The 220 principals were surveyed, including those provided with program materials and training and those who did not have this provision but may have obtained similar materials or accessed alternative ICT resources.

Principal survey responses for ICT and non-ICT program schools and the type of programs they are accessing is shown in Table 12. For example, a total of 82 principals indicated they had TV-Edukasi, including 74 which were ICT program schools and 8 which were non-ICT program schools. A total of 50 principals, including 46 from ICT program schools and 4 from non-ICT program schools, responded to the survey about this.

Table 12: ICT program access: principal responses

	TV-Edukasi	Portal Rumah Belajar	SEA-Edu-Net	School Net	Jardiknas	ICT Centres/ Minilabs	School based ICT initiatives	Uni support ed ICT	Yayasan supported ICT
	No. of schools	No. of schools	No. of schools	No. of schools	No. of schools	No. of schools	No. of schools	No. of schools	No. of schools
Total of Non-ICT school N=54	8	2	2	2	6	4	6	0	7
Total of ICT schools N=165	74	15	14	20	36	46	56	9	18
Overall N=219	82	17	16	22	42	50	62	9	25

Considering all ICT and non-ICT program schools, 82 (37.4%) out of all 219 principal responses to this question were indicating they had access to TV-Edukasi materials (and similarly this was indicated by 31.6% of teacher respondents).

Other details are:

- Between 7% and 10% of principals (and 9-10% of teachers) indicated in the survey their involvement in other ICT programs such as Portal Rumar Belajar, SEA Edu-Net and School Net.
- There were also 19.1% of principals indicating involvement in Jardiknas and 22.9% overall for ICT Centre program participation.
- Overall, about 28.4% of principals also provided information about school initiated ICT programs and approximately 11.4% have Yayasan supported programs.
- Few schools were involved in university supported ICT programs (1.4%).

The most valued and used activities were TV-E, Jardiknas and ICT Centres.

It should also be noted that there were variously about 20% 'don't know' responses from all categories of principal survey participants for the ICT programs listed. It has been noted previously in this report that there are a large number of new principals which may account for the 'don't know responses'.

5.2 TV-Edukasi

5.2.1 TV-Edukasi background information revisited

As previously outlined, during 2006, 2007, 2010 and 2011, over 1000 schools in Papua received the TV-E package consisting of one or two Television units, one DVD Player, one Satellite Dish, one Digital Satellite Receiver (decoder), one TV Tuner, and CDs with educational content. Some also received alternative power sources. Over 3000 villages were similarly supplied with TV-E for the purposes of improving community literacy. TV-E content included content relevant to Formal Education, Informal Education, Non-formal Education, and Education Information/news.

TV-E was broadcast through Channel 1 for students and Channel 2 for teachers, streamed live from Jakarta. There was a need for Papuan schools to adjust time zones by two hours so CDs of materials were eventually made and many schools used these rather than TV-Edukasi. Both ICT program schools and non ICT program schools were able to access the TV-E and CDs. ICT program schools had the hardware equipment or CDs provided by the government but some non-ICT program schools may have received televisions or power supplies or CDs from Yayasan and various donor agencies. The overall aim of the TV-Edukasi initiative was to bridge the gap of educational access quality being provided to schools, especially those in remote areas where online learning systems were not feasible because of lack of Internet or mobile telephone networks. Given concerns about its usefulness, the TV-E channels have not been operational in Papua since 2012.

The analogue technology was converted into digital technology in 2011, and content became streamed throughout Indonesia and available online at <http://TV-E.kemdikbud.go.id/>. This availability was still evident at the time when the evaluation was being conducted. However of course, only those schools with internet connectivity benefitted.

5.2.2 TV-E –Edukasi training

Training about using TV-Edukasi (TV-E) was provided to teachers and principals in the ICT program schools by Pustekkom and eventually BPP. Interviews with BPP staff indicated that

over 1500 people received training during 2008-2010. As previously outlined, training included establishing clear expectations that those receiving TV-E packages were expected to incorporate TV-E broadcast or recorded programs into teaching and learning in the classroom and into independent learning homework or groupwork. It was expected that preparatory activities would occur to match the TV-E program and the curriculum, followed by TV-E viewing and comprehension and follow up activities such as questions, discussion and worksheets (Pustekkom Depdiknas, 2007).

Approximately 95.73% of teachers and 96.15% of principals attending professional development sessions indicated a positive response about the training. Nearly 20% of principal and teacher respondents said there was no TV-Edukasi training for them because their schools did not have the ICT program. Additionally about 10% indicated they did have the ICT program provided to them but no professional development was offered.

5.2.3 TV-E use and frequency

To ascertain information about the use and frequency of use of TV-E as a key focal area for this evaluation, survey responses from principals and from teachers about actual TV-Edukasi use and the frequency of use, were examined.

Whether being an ICT program school or not, there was minimal indication of the use of the TV-E programs by principals/their staff in principal responses and similarly in teacher survey responses. Fifty percent of all principals indicated no use of TV-E by themselves or their staff and 16.9% indicated use at only about once a month (with principal responses for ICT program schools and no use being 49.5% and for non-ICT program schools being only slightly higher at 52.9%). Similarly 54.1% of teachers from ICT program schools were indicating no use (and similarly 57.8% of teachers from non-ICT program schools).

As evident in Table 13, daily use or 2-3 times a week use by both teachers and principals was generally only indicated in about 20% of responses.

Table 13: TV-Edukasi frequency of use by principals and teachers

	1 or more times daily %	2-3 times weekly %	About once weekly %	About once monthly %	Never %
Principal: ICT program schools N=107	7.5	14.0	12.1	16.8	49.5
Principal: non ICT program schools N=17	11.8	11.8	5.9	17.6	52.9
Principal: all schools N=124	8.1	13.7	11.3	16.9	50.0
Teacher: ICT program schools N=677	8.6	10.0	12.9	14.4	54.1
Teacher: non ICT schools N=83	4.8	8.4	13.3	15.7	57.8
Teacher: all schools N=710	8.2	9.9	13.0	14.5	54.5

Given that the TV channels have not been operational since 2012, principal and teacher respondents who are indicating use to varying degrees may be referring to general use over the past few years. Or they may be referring to the use of CDs which were only provided in recent times because of the Jakarta time zone problems being experienced by Papua schools.

The principal survey (N=123) showed about 40.7% of all principals (ICT and non-ICT program schools) were indicating that they or their staff were using the CDs. Approximately 30% of all teachers who answered this question (N=783) responded that this resource was being used (and 70% indicated no use). Some specific differences in use of various categories of respondents are:

- differences in TV-E CD/DVD use between ICT program school (31.6%) teacher use and non-ICT program schools (18.1% teacher use);
- teacher TV-E CD/DVD use being somewhat similar across urban (32.4%), peri-urban (25%) and remote (24.1%) schools, and
- teacher survey responses indicating that 48.3% had seen the CDs and DVDs, while 34.4% had not seen them (and 17.2% gave 'don't know' responses).

The Keerom case study undertaken for this evaluation also indicated minimal use of TV-E CDs/DVDs in the three schools visited, with only 4 sets of DVDs being available for maths, language, biology/physics and for natural sciences.

Regarding usefulness of the TV-E CDs, of those using the resources, 90.78% of principals and 93.35% teachers gave useful/very useful responses about the TV-E CDs/DVDs. Of further interest is that 48.1% of the overall response group gave 'don't know' responses about the CDs/DVDs. The lack of knowledge about TV-E is not surprising, given that years in current position demographics previously outlined indicated many teachers being less than five years in those roles. The majority of distribution and infrastructure training is likely to have pre-dated in the commencement of teaching duties for many teachers.

5.2.4 Specific use and usefulness of TV-E

In survey open response questions from principals and teachers, specific examples of TV-Edukasi programs used related to both the teacher and student channels' content. For example, various respondents commented that the TV channels were more frequently used in the 2006-2009 timeframe but less frequent use of TV-Edukasi occurred after that timeframe.

Teachers and principals indicated in the survey that for their own work and learning they watched programs which showed them learning methods for the Indonesian language or other subjects. Additionally, TV-E provided additional references to support their lesson preparations. The main specific focus areas indicated by individuals about TV-Edukasi were programs about national exams, maths, science program and Indonesian language programs.

Some specific comments made by principals were as follows:

- '...the school is in need of TV-E program, because it is useful for the development of teacher professionals to improve'.
- 'For each subject there is a DVD that can be used by students and teachers'.⁹

⁹ The principal was unaware that CDs/DVDs were only available for some subjects. This may indicate that dissemination of information is randomized.

- ‘TV-Educational is very helpful in school because through this medium we can obtain information...about education and other social information’.

Regarding use for students, various specific program types were detailed in open survey responses including news broadcasts (Reuters, TV-E One, News One), also programs about science and technology (with biology and physics specifically mentioned by various people), sports, arts/folk dancing, maths and associated quizzes and English language learning programs.

For example, one specific example by a teacher indicated:

- ‘...watched about IPA from the Sumatran region on how to make skewers of meat snail and about the experience of school children looking for snails and fish on the seafont and we are pleased to be able to watch the event’

Regarding the usefulness of TV-E materials, about 97.7% of principals indicating they used TV-Edukasi, gave useful/very useful responses and similarly about 96.19% of teachers. However 50% of principals indicated no TV-Edukasi use by self or staff.

A principal comment about the general usefulness of TV-E indicated that the ‘Package TV-E is very important, especially in rural areas of society.... especially for schools that lack teachers’.

Another comment was that ‘The use of TV-education is very useful as a source of learning and to broaden teachers personally and as teaching material for students’.

Teacher comments about TV-E were about access to new information or new educational approaches. For example:

- ‘if there is new knowledge for me then I record and convey to my students’
- ‘TV education is a major rerunning broadcast on TV ..used as one of the strategies in an effort to increase student interest... have made use of such means to be a learning support. Students have been invited to listen to the show that aired on TV education, and it is loved by the students’.

In the Keerom case study conducted for this evaluation, all three schools (SMA, SMP and a private school, with some having TV-Edukasi training and equipment), indicated its value giving the popularity of the television medium. Interviewees stated that many events of interest were explained through this media and teachers obtained ideas about new teaching techniques. Additionally, TV-Edukasi was used as an alternative or substitute for teacher presence and it could be implemented with minimal teacher planning. On the other hand, in the case study, those interviewed indicated that the TVs had screen that were too small for large groups of students (see Appendix D for more information about Keerom case study).

In other focus group interviews conducted in various schools, some teachers indicated that TV-Edukasi and the CDs are outdated and this type of material does not hold student interest, especially given the materials available through digital technologies.

5.3 Non-formal learning in community centres and TV-E

A specific question was asked of principals in the survey to ascertain if respondents were aware of the community TV-E program in which 3000 rural villages were given hardware similar to the TV-E packages. Very few responses were provided by principals, with the general comment being that the school ICT program was not available to the community.

Occasionally principals stated that the school's TV-E resources were used for school meetings or social occasions.

In the case study work in Merauke, representatives of one of the community learning centres supplied with TV-Edukasi hardware were interviewed. They indicated that while the centre was still operating and continuing to provide community literacy and vocational programs, TV-E hardware was not working.

5.4 Use and usefulness of other ICT programs

Low usage and access rates were evident for Portal Rumah Belajar, SEA Edu-Net, School Net/Jardiknas, with about 75% of teacher respondents (N=809) and 88% of principal respondents (N=122) never using these resources. Jardiknas and ICT Centres 'never use' response was only about 65% among principals and similarly regarding Jardiknas use for teachers.

For teacher and principal responses about the usefulness of various materials (N=896 for teachers, N= 113 for principals), about half of the respondents for each category indicated the resources as not being applicable to their schools. In cases where the resources were applicable, most responses indicated very useful/useful for each resource.

Only a few teachers and principals in their open responses in the survey indicated any details about their use of School Net or Portal Rumah Belajar materials. News, sports, science, technology, national examination information and animation were aspects indicated. Generally browsing and searching for information were the main areas of use outlined for School Net.

An example comment about various ICT program materials and their usefulness:

- 'Educational television.... can adopt and apply some variety of learning. Portal home study is used as an additional source of learning.... Central ICT & ICT labs: used for learning in classes and some other tasks. School-based ICT initiatives, used at any time on learning'.
- 'Education TV, very useful, because it contributes knowledge about information, so as to keep abreast of today's world. Jardiknas, very useful, helping to find teaching materials and obtain new things using online learning resources, it is very useful, because if I need some books, I can easily access it by simply typing judulbuku and author'.
- 'ICT programs are used as a medium of learning that can be directly viewed by students... provide useful knowledge impact and in accordance with the substance/ material being taught'.

5.5 Challenges for TV-E and other ICT programs

Teacher and principal open responses in surveys in regard to TV-E and other ICT programs indicated that there were a range of challenges in using the programs. For TV-E, while usage did not appear to be high across all teachers and principals, there were many issues indicated including television and antenna being damaged or stolen, Jakarta timing of televised sessions being inappropriate for Papuan schools given the two hour time difference. Other issues raised were about lack of electricity source or inappropriate electricity source or antennae not being supplied.

Similarly for Portal Rumah Belajar and School Net, there were issues indicated with regard to poor internet connectivity and lack of power.

5.6 Summary

This chapter has focused on the teaching and learning aspects relevant to using ICT program materials, such as TV-Edukasi, Portal Rumah Belajar, SEA Edu-Net, and School Net/Jardiknas. Many of the materials and training were essentially provided four or five years ago and some resources are no longer available. Given that many teacher survey respondents are relatively new to their teaching positions, it is not surprising that many did not answer these questions or provided ‘don’t know’ responses.

For those who did reply and had used the resources, the materials were valued especially the TV-E CDs/DVDs.

Some of the key findings about teaching and learning using the ICT program materials are:

- 37.4% of principals surveyed had access to TV-Edukasi materials;
- over 95% of principals and teachers who underwent TV-Edukasi training, were positive about it;
- variously, 7-10% of principals indicated having access to ICT programs such as Portal Rumah Belajar, SEA Edu-Net, School net;
- about 22.9% of principals indicated participation in ICT Centres/Minilabs;
- about 19.1% of principals indicated participation in Jardiknas;
- about 50% of principals indicated no TV-Edukasi use by self or teachers;
- about 40% of principals and 30% of staff cited some use of TV-E CDs and DVDs although not necessarily frequently, and
- for Portal Rumah Belajar, SEA Edu-Net, School net, Jardiknas and ICT Centres/Mini Labs, in contexts where the resources were applicable, over 90% responses indicated very useful/useful responses for each of the resources.

For those principals and teachers using TV-E CDs/DVDs or previously using TV-Edukasi, many have indicated useful/very useful responses. However there were up to 50% ‘don’t know’ responses about CDs/DVDs, perhaps because many teachers are relatively new to their current positions.

Given that TV-E CDs/DVDs are valued by some teachers and principals, consideration towards redevelopment, updating and re-issuance, as well as further promotion and training, is a possibility. This may be the case in more remote areas with power access, and may represent a valuable resource given that internet connectivity is not expected to improve in the near future, although regular and reliable power supply issues remain and will need to be addressed.

Chapter 6: ICT Centres and related ICT programs

This chapter relates to research area 2 and to programs associated with teaching and learning of teachers and students as relevant to ICT Centres. The history of ICT Centres is outlined including in regard to current strategic directions and future roles, many of which are associated with improved educational and financial management and the need for training of teachers and principals as well as educational office staff at the provincial, regency and district levels. Aspects related to the internet are also introduced in this chapter.

6.1 Background to ICT Centres

6.1.1 Background

The establishment of ICT Centres for improving teaching and learning, and teacher and leader professional development in Papua can be traced back about a decade. Interviewees indicated that at that time a decree was issued by the education authorities that one SMK in every regency was to be established as an ICT Centre. A VSAT was provided and additional funds were given to the ICT Centres, with the intention being that they could provide training for others. Depending on the number of students, about 20 computers were supplied.

An example of the role of the ICT Centre was outlined earlier in this report in regard to Keerom's *Digital Learning for Teachers Professional Development program* or *Teacher Open Lesson* program. This two year research program from 2009 to 2011 involving universities and with financial support from the Ministry, involved leveraging ICT in the form of digital media learning by increasing teaching skills in mathematics and science, also involving capacity building within Teacher Education Programs. Face to face sessions, weekly distance learning sessions, and virtual class observations were involved, with practical sessions being video recorded and streamed to other teachers in other schools to provide opportunities for classroom observations and to elicit feedback and reflections on teaching practices (Modouw, 2011).

In 2010, further funding support was given to these Centres by the Ministry of Education in Jakarta, with the SMK schools involved receiving an additional 100 million rupiah to improve buildings and equipment such that quality facilities were provided, as well as an air conditioned environment. The *ICT in Education Strategy and Implementation Plan for Education in Papua 2010-2014* indicates the plan which was for 60 ICT Centres for professional development, with ICT stations being provided for SD sites. Intended provisions were:

- ICT Centres in Tier 1 Schools: Lab of 20 PCs, plus DSL networking
- ICT Centres in Tier 2 schools: lab or 20 PCs, plus high speed VSAT and solar power
- Minilabs in Tier 1 schools: Lab of 10 laptops, plus DSL networking.
- Minilabs for Tier 2/Tier 3 schools: Lab of 10 PCs plus low-speed VSAT and solar power.
- SD Station in SDs Tier 1 schools: one laptop, plus DSL networking
- SD Station in Tier 2 SDs: one laptop, low-speed VSAT
- SD Station in Tier 3 SDs: one laptop, low speed VSAT and solar power (The World Bank, 2010).

The *ICT in Education Strategy and Implementation Plan for Education in Papua 2010-2014* provides a context for the use of ICT to make improvements in educational and financial management both at the school, district and regency office level. The strategy reflects concern about quality and reliability of data and has been used to introduce and provide training for the use of simple, spreadsheet-based reporting tools by schools. Training and integrating information management into ICT Leadership programs and into basic ICT programs for SD school leaders and training personnel in district offices and DIKPORA to receive and process electronic files, are specific aspects identified in the strategy. A monitoring role for education authorities was also outlined.

In the research work involved in this evaluation, it was not clear whether all of the ICT centres had been established, with the main focus for the surveys and interview work being in regard to SD and SMP schools. The ICT Centres were generally focused in SMK and SMA locations. However case study information did indicate that ICT Centres were continuing to train staff from other schools to some extent. Evidence indicates that some SMK and SMA teachers and leaders are seemingly going to Java for training and then returning to Papua to train others, particularly training those staff in the local regency and district.

6.1.2 ICT Centre role

Beyond professional development for teaching and learning, an increasingly important role for ICT Centres, as outlined by various interviewees in Dinas Pendidikan and school roles, is in regard to administrative functions. ICT Centres are being used as a location for principals without internet access to input data required by the education system. Qualifications of teachers and principals are also being evaluated online, with ICT Centres providing a venue for this. Teachers also continue to approach ICT Centres for help with ICT issues.

In the near future, ICT Centres will have a role as student online examination centres. However most of the current ICT Centres do not have enough equipment for 240 students, so the national exam online cannot occur until 2016. In some regencies, further expansion of ICT Centres is currently underway, including ensuring there is sufficient electricity available.

6.1.3 Sample schools as ICT Centres

In the survey, 22.9% of principals (N=218) indicated that their school was an ICT Centre or was associated with a centre, although 14.2 % of respondents did not know.

Considering hardware which was usually provided to schools which were ICT Centres, 13% of principal respondents indicated receiving VSAT, 68.9% did not and 18.1% did not know. (N=193). Genset/solar cells/minihydro devices for power were generally provided where there were electricity problems. This was indicated as being received by 28.6% of respondents, with 58.9% not receiving this and with 12.5% not knowing about this. About 7% of principal respondents also indicated that they had received DSL. About 13% of all principals indicated that VSAT to support internet connectivity was supplied to them and about half of them indicated it was still working. About 70% indicated it was not supplied (about 18% did not know if it was supplied).

Examining the 192 responses from principals, 17.7% received a lab of PCs. One hundred and forty principals also gave information about the number of PCs, with 36 schools receiving no PCs and others receiving various quantities of equipment, amounting to 40 PCs. For example, one school received 40 PCs, one school received 28 PCs and one

school was provided with 25 PCs (and 4 with 20 PCs). Three schools got 19 PCs, two schools received 18 PCs and five schools got 17 PCs. Six schools were provided with 10 PCs. Other schools were given varying numbers of PCs of less than ten hardware items. Mostly principals seemed to be indicating that the PCs were still working.

Regarding Genset/solar cells/mini hydro, approximately half of those principals indicating the school had received this device, also stated that the items were still working.

6.1.4 Frequency of use

Regarding frequency of use of ICT centres, 15.6% of principal responses (N=122) indicated that principals or staff were using the ICT Centre daily or 2-3 times a week and 64.8% indicated this had never occurred. About 14% of responding teachers (N=697) indicated daily/2-3 times a week use and 58.5% identified no use.

6.1.5 Usefulness

There were 113 principals and 641 teachers who responded to the question about the usefulness of ICT Centres. For those using the ICT Centres, a high percentage (93.8%) of respondent principals indicated that ICT Centres were useful/very useful and 95.3% of teachers responded similarly.

6.2 Internet provision arrangements

In the focus groups in schools and in interviews with principals and with telecommunications providers, a range of internet provision arrangements were evident. At this stage prior to the commencement of the fibre optic cable, all schools which are accessing the internet do so through satellite towers, VSAT or mini towers. Many remote locations have no such access for either telephone or internet.

The costs of the internet service have been offset for some schools because of the mobile internet service which visits various locations from time to time. Additionally, as previously outlined, Jardiknas and School Net have been available to some schools. About 10% of the principals surveyed indicated this availability for School Net and 19.3% for Jardiknas. Some schools are being supported with internet costs and equipment through NGOs.

In the case of most schools, where the education authorities are not providing internet, arrangements with private providers are occurring. In the focus groups, many principals had internet provision which costs about \$600 per month with organisations like Telkom Flash. Some Jayapura schools in the specially conducted case study also indicated considerable expenses for internet connectivity with costs being around 8.5 million rupiah a month, especially since government subsidies have been discontinued (see case study in Appendix E).

Principals in some focus groups revealed they are now cooperating with other SD, SMP, SMK and SMA schools to make combined and cost effective deals with Telkom and other providers in regard to internet connectivity access.

Some of the internet arrangements through NGOs and Jardiknas currently seem to be in transition. For example in the evaluation case study conducted in Keerom, interviewees at

various schools indicated that Internet access was provided by a range of different means: towers were available for internet at some schools with Dinas Pendidikan support or equipment and costs were covered by NGOs (including their building of libraries in the District with VSAT links and computers). Support was also provided through Jardiknas, with school committees also supporting internet costs and with parents paying 10000 rupiah per month for internet access. However ownership of the towers was reverting to schools at the end of March 2015, with internet access costs then reverting to schools at the cost of about 2.5 million per month. In places like Keerom, speed is quite slow at about 64Kbps. Keerom will not gain fibre optic services when this commences but speed and reliability may be increased because more satellite towers will be available for this region.

In regional areas, local internet cafes were sometimes being used when reliable internet was not available for school administration or teacher preparation tasks. This was certainly evident in the Nabire case study (See Appendix E). Schools in this area and also in Merauke were using the services of mobile internet vans (M-PLIK) which have been available in the past (although not currently operating). One issue raised about the mobile vans was that the schedules were not always clear which made pre-planning for the use of the service difficult.

6.3 Internet supports and challenges

Throughout all principal, teacher and student survey responses, the lack of availability of the internet and power or unstable and unreliable internet were constant issues being raised. Students in their open response questions indicated a preference for using ICT and internet services to gain easier access to information and knowledge building and also for faster learning. However, the majority of student responses were related to the general ICT challenges such as no computers or ICT or lack of power and lack of internet provision or reliability.

Specifically student comments about internet challenges were:

- '...very slow internet access and hard to find the signal'
- 'Internet car has rarely come to school. Our computer lab is damaged. Our school has minimal equipment'
- 'We could not open the internet because there is no network'.

Various strategies were evident in the case study visits for improving internet connectivity such as using individual modems. Another innovative approach evident in the Nabire case study involved students in building an amplifier from a frypan as part of their specialist ICT classes (See Appendix E for details and photographs). In the Merauke and Nabire case studies, there was evidence of teachers and students owning Wifi dongles that could be used at home or at school to complete assignments and research, as well as being useful in preparing teaching materials.

Regarding principal and teacher survey responses about various supports and barriers to ICT use at school, the importance of reliable internet access was evident to some degree in their responses.

Table 14 provides responses from all principals and teachers and at the regency level as follows.

Table 14: Importance of reliable internet for ICT success

	All regencies %	Jayapura %	Keerom %	Merauke %	Boven Digoel %	Nabire %	Supiori %	Lanny Jaya %	Deiyai %
Principal N=220	51.4	50.0	48.4	48.1	41.7	60.0	55.6	52.2	25.0
Teachers N=1502	60.9	62.8	52.8	60.9	62.4	62.3	74.1	57.3	45.8

Generally, in looking at the table, there were about 50% or more respondents in each category indicating that reliable internet is important. However, there were also variations across regencies. Teachers usually rated this issue as more important than principals. For example in Supiori, 74.1% of teachers indicated this was important but only 55.6% of principals, whereas in Nabire about 60% of teachers and principals indicated importance. There were significant numbers of 'don't know' responses but generally about 20-30% of respondents in most regencies and also teachers were indicating a negative response about the importance of reliable internet. For principals the 'no' response was much stronger. Generally about 30% of them were indicating that reliable internet was not important.

While there are challenges with the Internet for some regencies, there are high hopes that when the Palapa Ring east fibre optic cable is turned on this year, improvements will occur. This is especially the case for Jayapura, Supiori, Biak, Sarmi and Merauke where improved connectivity is expected and lower costs. Other regional locations like Nabire will not get the fibre optic service but they, along with Keerom, Deiyai and Lanny Jaya, are expected to gain more satellite towers which will improve the connectivity situation in their locations.

6.4 Current and future use of ICT Centres

Interviews with Dinas Pendidikan officials and principals indicated that ICT centres will play an increasingly important role in Papua province, especially for the purposes of educational administration. Currently, many principals from remote locations do not have access to power or computers and laptops, let alone internet. Many education leaders at the regency and district levels are providing ICT Centre locations for remote location school leaders to complete administration tasks required by the education system. Teachers involved in competencies processes are also accessing ICT Centres to do their online assessments and this will continue into the future.

Furthermore, ICT Centres are still providing training for a wider group of teachers in their locations, with some of the ICT Centre staff gaining additional skills in Jakarta based training sessions and then being required to return to their locations to work with others. This role of ICT Centres is likely to continue into the future.

Additionally, Indonesia generally is working towards all students undertaking national examinations online in the next few years and ICT Centres are being established in all regencies to provide a location for this. However, it was evident in the interviews that Dinas Pendidikan officials in Papua have considerable work to do to ensure there are adequate rooms and computers for this to occur, with funding provision being an immediate task.

Beyond this, given lack of computers and ICT equipment generally available for student use and practice, particularly in some locations, there is considerable skill building needed for students to be able to undertake exams using technology, as will be outlined in the next chapter.

6.5 Summary

This chapter has focused on the teaching and learning aspects relevant to ICT centres

Some of the key findings about teaching and learning in ICT centres arising from principal survey responses are:

Hardware and usefulness of ICT Centres

- 22.9% indicated association with ICT Centres
- 13% received VSAT, 68.9% did not, 18.1% did not know (about half indicating the VSAT was still working)
- 17.7% received lab of PCs (between 1 and 40 PCs, dependent on school size)
- 93.82% of principals who used ICT Centres and 95.34% of teachers indicated they are useful/very useful.

ICT Centre frequency of use:

- 15.6% of all Principals giving a response (N=122) indicated daily/2-3 time week use; (64.8% never);
- Of teacher respondents, 14.7% indicated daily/2-3 times week use (58.5% never)
- About 10% of the principals surveyed indicated internet is available to them through School Net and 19.3% for Jardiknas and others have various private arrangements
- About 50% of principals and 60% of teachers believed internet efficiency is important to the success of ICT.

In the focus groups, many principals had internet provision which cost about \$600 per month with products like Telkom Flash. Some principals were indicating up to 8.5 million rupiah a month being required, especially since government subsidies have been discontinued.

Considering the future, interviews with telecommunications leaders indicated that when the Palapa Ring East fibre optic cable becomes operational later this year, improvements will occur especially for Jayapura, Biak, Sarmi, Supiori and Merauke. Improved connectivity is expected and lower costs. Other regional locations like Nabire will not get the fibre optic service but they, along with Keerom, Deiyai and Lanny Jaya, are expected to gain more satellite towers which will improve the connectivity situation for them.

It is unclear how remote locations will benefit without innovative solutions in reliable power, telecommunications and satellite being implemented by governments or through partnership arrangements.

Chapter 7: Other ICT for teaching, learning and administration

The previous sections of the report were focused on programs such as TV-Edukasi, Portal Rumah Belajar, SEA Edu-Net and ICT Centres and associated programs, highlighting various policy and strategic directions contexts and implementation aspects which were relevant.

Beyond these evaluation aspects, research area two is about examining implementation of other ICTs in teaching, learning and administration, for students and for staff and principals. The findings are outlined in this chapter including in regard to the use of computers, laptops, printers, software and LCD projectors.

7.1 Student ICT use

7.1.1 Specialist ICT classes

Student ICT use occurs within specialist ICT subjects or through integration within other subjects.

Prior to Curriculum 2013 changes, all students in Papua were required to undertake a specialist ICT subject occurring for several hours weekly with the intention of building skills in technology. Some larger schools have specialist ICT teachers who conduct these classes and there are computer laboratories available in some schools.

Table 15 shows student responses from all regencies in regard to the frequency of use of computers in the computer laboratory.

Table 15. Frequency of Computer use in computer labs: Student survey responses

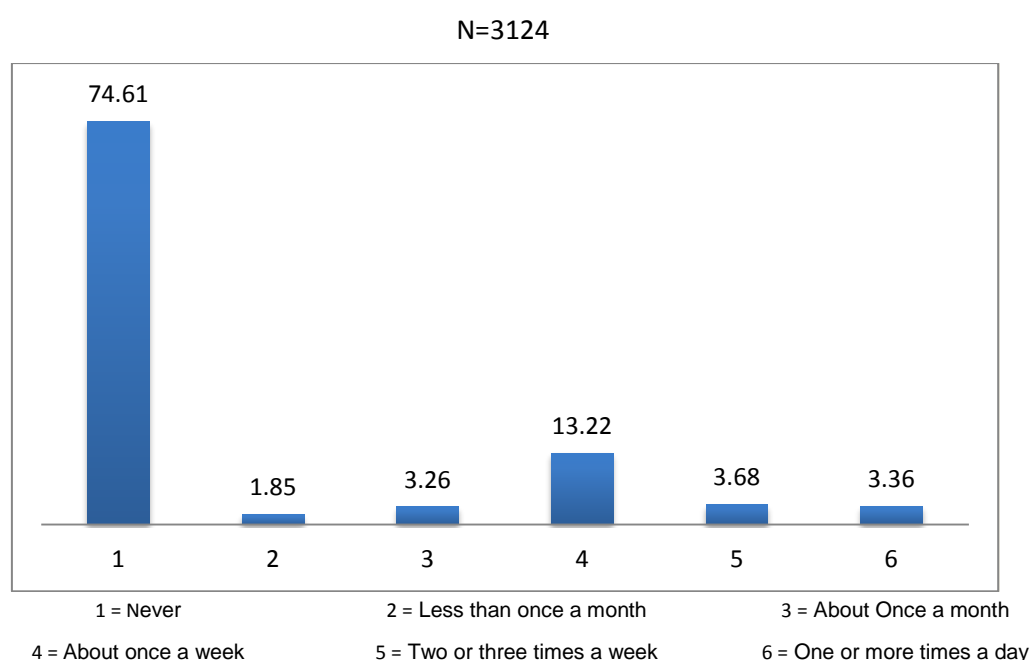


Table 15 shows that about 75% of students from across all regencies were indicating that they never use computers in the computer laboratory. Only about 20% of students indicate that they use this ICT at least weekly. Jayapura and Keerom regencies reflect this.

Figure 5 below indicates that Nabire has the highest use of ICT in computer rooms, with approximately 41% of students indicating that this happens at least weekly.

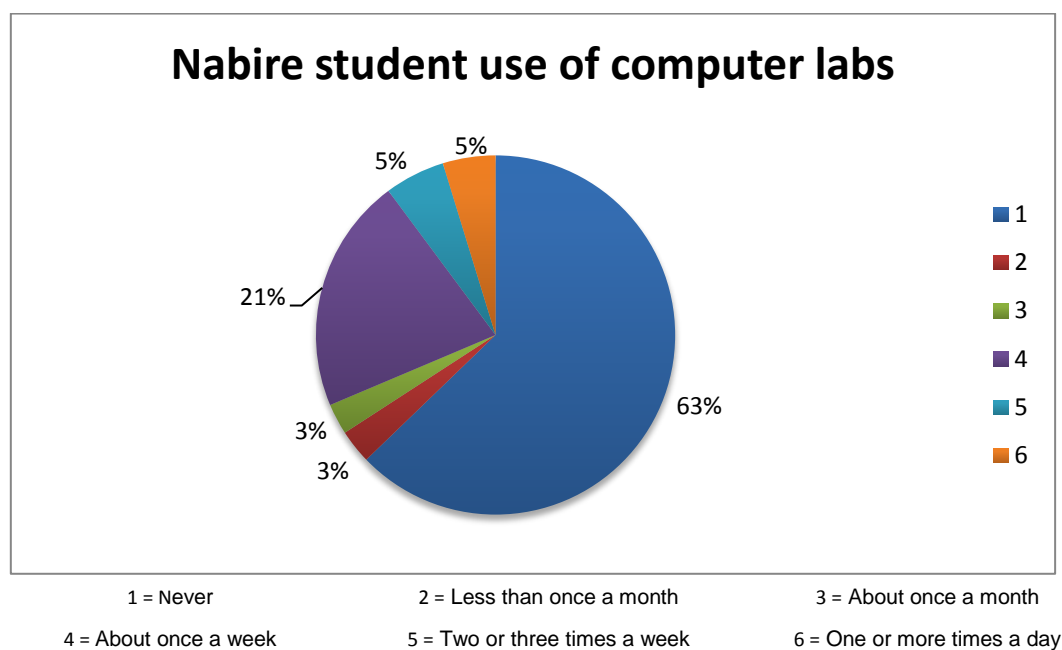


Figure 5. Nabire student use of computer labs

However, there are regency variations in student frequency of use of computer laboratories. Lanny Jaya is representative of those regencies. Many schools do not have computers available, electricity, or specialist teachers, but the specialist ICT class continues to be a required weekly lesson for all year levels.

Those students not accessing a computer lab are likely to be studying this subject through theory rather than actual practice. A textbook is available for specialist ICT classes which outlines the required program of study for various year levels. Essentially, from the information provided by students, the specialist subject is undertaken through book learning with their teachers. The reliance on books and didactic approaches with ICT studies was also evident in interviews undertaken in some of the case study school visits.

Students in the survey and in the focus group sessions indicated that in these specialist subject ICT sessions they were learning mainly about basic computer processes, building typing skills and using Excel, PowerPoint and Word. This is shown by a student in the survey response about activities undertaken who stated that teachers usually 'ask us to open Microsoft Word, Excel, PowerPoint'. At the secondary school level, students were also sometimes using the internet to search for information, learning about facebook and sometimes blogs, as well as learning about security and maintenance of computers. The majority of students in open responses about the use of computers at school said they don't have ICT equipment access at school or are only learning in specialist ICT lessons from books: 'The teacher introduced (ICT) through ICT print books'; 'We learn through textbooks' and 'I never use ICT to learn in school'.

A small minority of students in the focus group sessions also indicated that they undertake additional activities in specialist ICT such as animation, Corel draw, robotics or using publisher. For example, in the case studies undertaken for the evaluation, the researchers met representatives from one Nabire SMK school which had added supplementary materials to the specialist ICT program. In one of the supplementary activities, the specialist ICT teacher worked with students to develop an amplifier to improve internet connectivity. At another school in the area, this same teacher had introduced robotics and a specially selected group of students was doing this topic for their extra curricula studies each week.

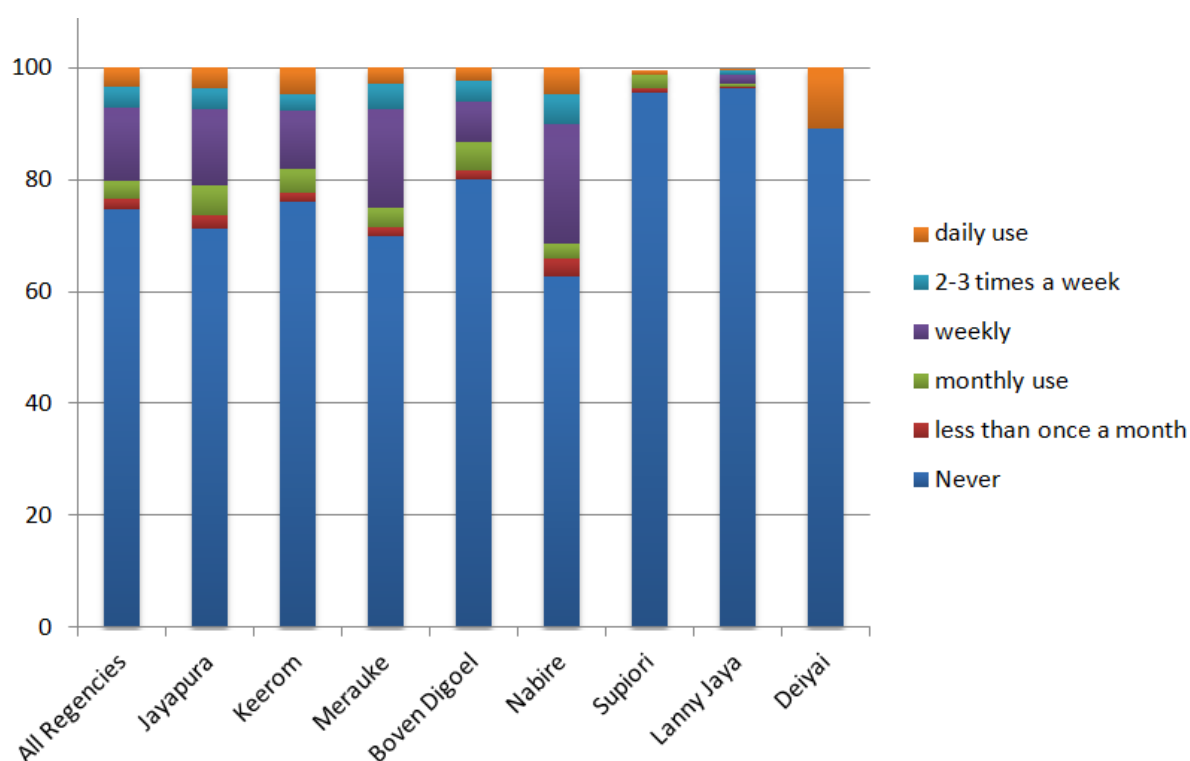
7.1.2 ICT integrated into other subjects: student data

In the other subjects where ICT is potentially integrated across the curriculum, students and teachers indicated in surveys or in focus group sessions that sometimes the teacher uses the LCD/Infocus to show materials to the class or students were using the photocopier, digital camera or the internet for web searches. This is reflected in one representative student comment in the survey, with the student indicating teacher and student ICT use as including activities such as: ‘material displayed via the LCD; bring laptops to school for the sake of presentations and assignments’.

A key issue raised in student surveys and in focus groups was the lack of ICT available in the classrooms, apart from the computer laboratory where essentially the specialist ICT classes or sometimes language classes were occurring. There was a minimal number of responses indicating the use of mobile phone technologies for tasks although there were some examples provided about using the calculator on the phone for maths problem solving or generally for accessing the internet: An example student comment was: ‘We use mobile phone technologies to access the Internet in school learning activities’.

This individual student comment was contrary to the usual situation. Generally, the responses indicated that students were not permitted to bring mobile phone technologies to school and laptops were only allowed to be brought along on some occasions.

Table 16 provides some details about student surveys and indications of using ICT in the classroom in various regencies and the frequency of use.

Table 16: Computer use in subjects in schools: Regency comparisons

The table shows that across all students and regencies (N=3124), about 15.5% of students were indicating using computers/laptop/tablets at school daily/ several times a week at school. About 70.7% of students across all regencies indicated that they never use these ICT items at school in the classroom. Jayapura and Keerom student responses align to this. In Nabire, slight less students [at 62.8% (N=196)] were indicating they have 'no' ICT use in their classes. However, for Deiyai, Lanny Jaya and Supiori, there were generally over 90% 'never' responses.

Considering what kind of equipment and ICT activities students are engaged in at schools across all regencies and frequency of use, 72.5 % of students indicated no use and only 16.5% indicated daily/2-3 times a week use. Between 81% and 93% were variously indicating no laptop use at school (85.4%), no tablet (88.2%) and no email (81.4%). No text messaging (90.1%) or use of digital camera (93.5%), were other responses. About 73% were indicating no internet use at school.

This can be contrasted with student indications about using computers, laptops or tablets at home on one day or 2-3 times a week basis with 41.4% generally indicating this. About 50% of Jayapura, Keerom, Boven Digoel, Merauke and Nabire student response rates stated about daily/2-3 times a week use at home. For Supiori there were 96.4% of students indicating they never used these items at home. For Lanny Jaya and Deiyai, no use at home was indicated by 83.2% and 74.5% of student respondents respectively.

Internet access at home was indicated for 23.2% of students although this figure was approximately 30% in Jayapura, Keerom, Boven Digoel and Nabire (and around 1% in Supiori and Lanny Jaya). Around 40-50% of students were accessing internet through the internet shop or in a public space, although not in Lanny Jaya or Supiori.

Student ownership of a mobile phone was generally approximating 70%, but only around 30% for Supiori and Deiyai (and around 14% for Lanny Jaya students). Even in grade 5, there was approximately 40% mobile phone ownership, rising to 50% for grade 6 and 70-80% for grades 7-9. Locational differences indicated about 70% mobile phone ownership by students in urban areas, 60% in peri-urban and 50% in remote.

There are some interesting issues raised here which will be discussed in a later chapter in this report, given the reasonably high use of laptops and mobile phone technologies at home for students in many regencies and the lack of equipment access at school generally evident.

7.1.3 ICT integrated into other subjects: principal and teacher data about student use

Teachers and principals in their surveys also provided details about student use of various items of ICT equipment including computers, laptops, tablets, photocopiers, internet, smartphone, mobile phone, digital camera (N=1380 for teachers but there were over 120 missing data items for principals (N=216). Similar to student responses, there was significant variation across regencies indicated by teachers and principals.

Table 17 provides details about student ICT use at school with considerable agreement evident between principal and teacher responses. Computers, televisions, and using handphones were indicated by more than 30% of principals and teachers as being student ICT activities. However, using laptops, printers, digital cameras and social media or email was only occurring about half as often. Internet use by students was indicated in about 21% of teacher and principal responses. Tablet use, mobile phone technologies and LCD/Infocus use by students was only occurring on a minimal basis.

Table 17: Student use of various ICT at school: Principal/Teacher survey responses

	Principals N=216 %	Teachers N=1380 %
Computer	33.2	32.2
Laptop	15.0	17.0
Tablet	5.3	8.0
Printer	19.1	15.2
LCD	9.8	17.0
Digital camera	14.6	10.2
Smart phone	11.9	16.9
Hand phone	30.0	33.6
TV	35.4	26.5
DVD	22.2	17.2
Photocopier	11.8	11.0
Social media	18.5	19.4
Email	14.4	13.7
School web	7.1	7.9
Internet	21.8	21.1

While some students are using some ICT in their subjects, students in the survey did not report that this occurs very often. Figure 6 captures this information.

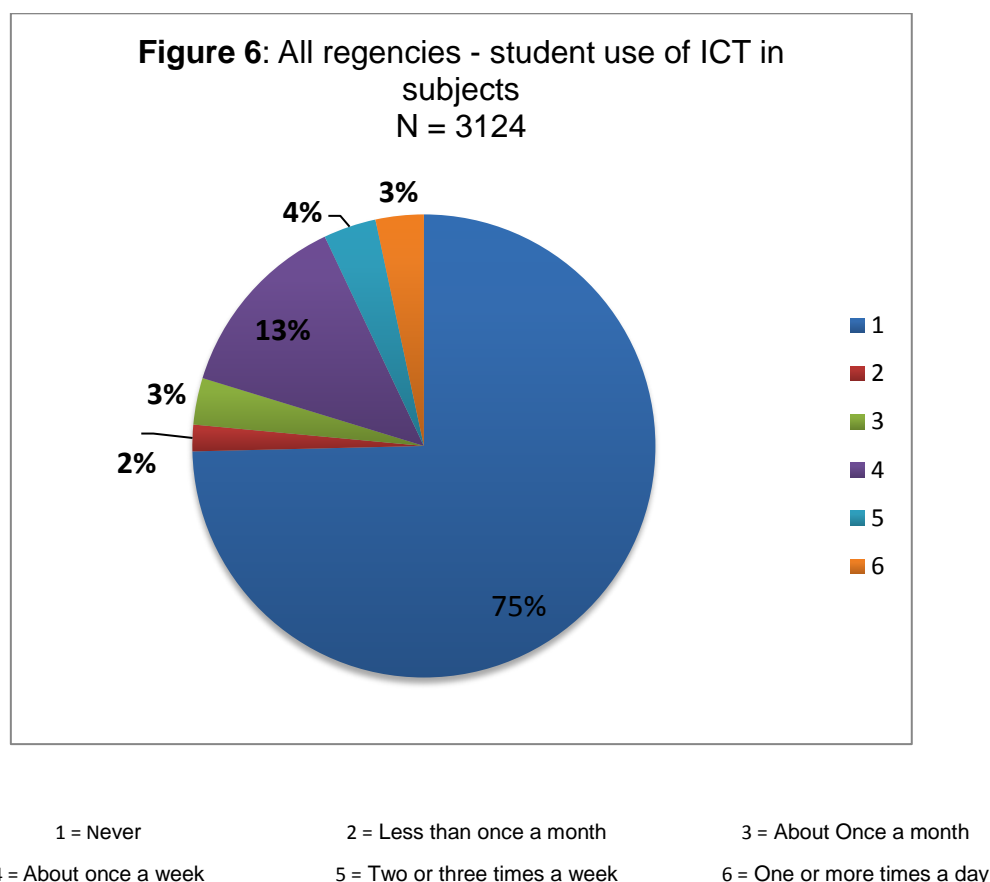


Figure 6. Student use of ICTs in subjects

As shown in Figure 6, the predominant response from students was that they ‘never’ use computers, laptops and other ICTs in their subjects.

While much of the student use of ICT was at a basic level in SD and SMP schools, in the Jayapura and also Merauke and Nabire case studies especially conducted for this evaluation, there were examples of senior students accessing professional equipment for multimedia and sometimes even undertaking paid tasks for local business and community using these skills (see Appendix E). For example, reflecting private and public partnerships and real life learning tasks, SMK3 Merauke is an innovative school which prepares students for life beyond school in non-academic areas, thereby requiring engaging with private and public groups such as telecommunications, tractor companies and media groups and businesses. The significant feature of this school is its approach to planning curriculum, including ICT. On the occasion of the case study visit, teachers were developing five year curriculum plans based around inquiry and problem solving using real world scenarios. ICT was planned to be embedded in all subjects (Curriculum 2013). ICT hardware and software extended beyond desktop computers using MS Word and MS Excel. Evidenced were professional grade video equipment (operated by students), digital cameras, laptops and notebooks, audio recorders, the use of blogs and wikis, multimedia software and a Learning Management System. Video monitoring of public spaces was secured with CCTV ensuring student safety.

7.2 Principal and Teacher use of ICT at school

7.2.1 Type of ICT use: equipment and processes

Beyond student use of ICT at school, ICT usage by teachers in relation to their work in schools was also investigated. Table 18 provides principal and teacher responses to various ICT items and processes.

Table 18: Principal/Teacher own use of various ICT at school

	Principals N=216 %	Teachers N=1380 %
Computer	57.3	53.1
Laptop	71.2	64.2
Tablet	18.0	19.2
Printer	71.0	65.0
LCD	50.0	42.2
Digital camera	43.4	34.1
Smart phone	30.9	39.9
Hand phone	71.1	72.1
TV	56.9	55.9
DVD	40.6	36.3
Photocopier	31.7	37.1
Social media	32.6	39.9
Email	51.8	45.5
School web	39.2	27.9
Internet	67.1	43.6

Table 18 shows that 64%-70% of respondents cited use of laptops, printers and handphones in regard to schoolwork for themselves. Television, email and LCD/Infocus use was cited for 42%-56% of principals and teachers. Internet use seemed to vary for principals and teachers, with 67.1% of principals indicating its use and 43.6% of teachers. Smart phone, social media school website and social media use for both groups was variously about 27%-39%. Tablet use had the lowest use for principals and for teachers, with only 18%-19% of respondents stating usage.

Regarding frequency of use of some selected ICT at school, Table 19 provides details: Further detailed information is contained in Appendix G.

Table 19: Principal/Teacher frequency of use of selected ICT

Principals N=218			Teachers N=1500	
	Daily/ 2-3 times week %	Never	Daily/ 2-3 times week %	Never
Computers	42.9	41.1	27.3	48.5
Laptops	60.8	27.4	41.8	37.8
Tablets	10.3	88.3	11.4	82.6
Internet	27.1	55.0	28.2	56.3
Email	22.7	52.8	11.7	68.4

Table 19 indicates that about 40% of principals and 27% of teachers have daily or 2-3 times a week use of computers (and about 40-50% never).

Other points of interest in the table are:

- Laptops are used more often than computers with about 60% of principals having daily/2-3times weekly use and about 40% of teachers (and with about 27% of principals and 41% of teachers never using laptops).
- Tablets are minimally used, with only about 10% daily/2-3 times a week for both principals and teachers. Over 80% for each group never use tablets.
- Internet use occurs daily/2-3 times weekly for about 27% of principals and of teachers. Approximately 55% of each group never used the internet.
- Email use on a daily/2-3 times a week basis was higher for principals (32.7%) than teachers (11.7%) but over half of both groups were 'never' using email.

A particular point of interest for classroom teachers integrating ICT across subjects is the use of LCD and a laptop. A few schools have LCDs for almost all classrooms. Most have only a few LCDs. However in the focus groups, the potential for LCDs and laptops to support pedagogical change was raised in that these ICT can enable more movies, animation and a wider range of materials to be displayed than are enabled when textbooks are used. Given a lack of LCDs, one teacher in a focus group indicated he planned his lesson at home including interesting materials and then brought his laptop to school and showed materials to students one by one, thus building their interest and knowledge.

However there were also some teachers who seemed to be indicating that computers and laptops are mainly used for administration not for teaching and working with students in classes. For example, one teacher indicated:

'Computers are used for school administration, such as teacher absenteeism, important papers, typing questions..... While for learning.... never used'.

7.2.2 Software use for principals and teachers

The type of ICT use indicated by principals (N=218) and teachers (N=1500) reflected administration, and teaching and learning aspects, with the role of the principals sometimes including a mix of these responsibilities. This was reflected in some differences in ICT use between the two groups, as evident in Table 20:

Table 20: Percentage of cohort using ICT for specified purpose

ICT usage	Teacher N= 1500	Principal N= 219
1. Presentations	50.4%	54.8%
2. Email	29.1%	45.0%
3. Internet research	24.4%	23.0%
4. Assessment and Reporting to parents	54.2%	63.3%
5. Class attendance	72.5%	69.1%
6. Social networking with colleagues	51.2%	32.7%
7. Supporting students to achieve the outcomes required for Curriculum 2013	70.5%	69.6%

As Table 20 shows, approximately 70% of teacher use was connected with classroom administration or preparation of lessons. Making a list of student attendees (72.5%), supporting students to achieve the outcomes required for Curriculum 2013 (70.5%) as well as assessment and reporting to parents (54.2%) were the most common ICT tasks. For principals who have a mix of administration and in some cases teaching responsibilities, making a list of attendees (69.1%), assessment and reporting to parents (63.3%) and presentations (54.8%) were the most common ICT uses, followed by email (45.0%). For both principals and teachers only about 23-24% ICT use was connected with Internet research (23.0%).

Regarding frequency of ICT use by principals and teachers for specific types of software, Word documents were used weekly/2-3 times a week for 39.6% of teachers, with spreadsheets being undertaken with similar regularity by 28.7% of teachers. Principals also undertook daily-2-3 times a week use of Word (43.1%) and other uses were indicated by about 15%-18% of principals as occurring weekly/2-3 times a week such as for spreadsheets, using graphics software, PowerPoint.

A wider range of teacher use of software was also evident for some teachers in the case studies, although this was certainly not widespread. In the Jayapura and Nabire case study contexts, teachers were preparing lessons using self produced animation, short videos and other images. Some schools were providing teachers with free internet access from home under the school internet arrangements.

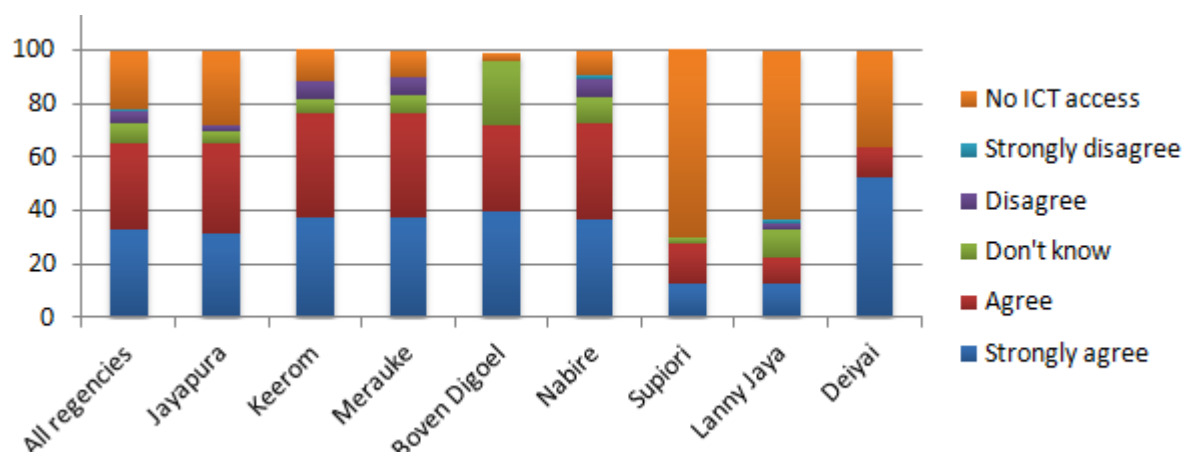
Home use by principals and teachers of various types of ICT was especially focused on laptops (81.3% for principals, 80% for teachers) and printers (65.4% for principals, 58.1% for teachers). Other items used frequently were DVD players (44.5% for principals, 48.1% for teachers), digital cameras 49.1% for principals, 37.2% for teachers) and mobile phone technologies (28.4% for principals 38.4% for teachers). Home use of text messaging (78.1% for principals, 83.8% for teachers) and accessing the internet for social media usage (32.7% for principals, 48.1% for teachers) were other frequent activities.

7.3 Pedagogy

While teachers indicate that they are using various items of ICT at home and at school, much of the school use was indicated to be for administration purposes such as preparing for lessons, using printers, doing assessment and reporting, sometimes using the LCD in the

classroom. Students in their responses recognise this use of ICT in many of the regencies and this is evident in Table 21:

Table 21: Student survey responses across regencies regarding teachers use of a range of ICT



In Table 21, about 64.9% of all students are strongly agreeing/agreeing that the teacher uses a range of ICT, with results for Jayapura being reflective of this at a regency level. For Keerom, Boven Digoel, Merauke and Nabire, this rises above 70%. For Supiori, and Lanny Jaya, no ICT access is evident for 70% and 63.5% of students respectively.

While some teachers are using ICT in the classroom such as the LCD and a laptop for demonstrating information, what is less evident is the use of ICT by students and also teachers using technology to really support students to be independent, creative and collaborative across ICT integrated across subjects.

Each of the case studies undertaken by the evaluators highlighted the issue of ICT and pedagogy and the need for professional learning support but also for equipment. For example, in the Merauke case study report (see Appendix E), lack of access to sufficient laptops was limiting the opportunities for subject teachers to include more ICT in their pedagogical repertoire and to support student learning.

However, given student high ownership levels of mobile phones and laptops, ICT access is more widely available in real terms indicates that school policies may need rethinking. Principals have indicated in their survey in the open responses that their schools have policies about mobile phone technologies such as smartphone use but there was no clear indication about whether this was a support or a barrier. The key point is that allowing students to bring their laptops and mobile phone technologies to school is a way of overcoming access issues and this may allow teachers to start rethinking pedagogy and integrating ICT into all lessons, with students sharing and working collaboratively in their learning.

7.4 Summary

This chapter has focused on the teaching and learning aspects relevant to using computers, laptops and software.

Some of the key findings about student use of computers, laptops and other software have been outlined.

- Little classroom or computer room use of ICT evident across all regencies and ages/classes with 75% and 70% respectively of all students indicating they never use computers /laptops/tablets in the computer laboratory and only about 20% indicate that they use this ICT at least weekly (e.g. Jayapura, Keerom).
- For Nabire, there was 31.38% at least weekly basis use of ICT in the computer lab. For some regencies there is virtually no computer lab use e.g. Supiori.
- Many students indicate no equipment, broken equipment, lack of power, lack of internet problems.
- Many students indicate high levels of ownership by students of laptops and smartphone but many students are not allowed to bring their own equipment to school and principals indicating policies about this.
- Between 81% and 93% of students are variously indicating no laptop use at school or tablets, and never using email or text messaging, or digital cameras.
- About 73% of students are indicating no internet use at school.
- Compulsory computer lessons weekly for students are essentially focused on basic computer processes, building typing skills and using Excel, PowerPoint and Word, with little creative work evident.

There are certainly issues raised here because students have minimal access to ICT hardware at school but are generally not being permitted to bring relevant equipment from home. This needs serious reconsideration.

Regarding teacher and principal use of computers and laptops, about 70% of use is connected with classroom administration or preparation of lessons rather than with actual use in the classroom in direct connection to student learning. Teachers using ICTs in the classrooms has real potential for reinvigorating lessons and building student interest and engagement and this needs considerable teacher professional development to build understanding and explore its potential.

Chapter 8: Infrastructure, Planning, and Funding for ICT

This chapter relates to research area 2 and infrastructure, outlining hardware, maintenance, planning, funding supports and challenges for ICT in education for administration and for teaching and learning.

8.1 Hardware

8.1.1 Current ICT hardware

An additional principal telephone survey was undertaken regarding hardware currently available in schools such as the numbers of PCs, laptops, tablets, LCDs and televisions. This additional survey was undertaken such that survey and focus group responses about teaching and learning processes could be contextualised, as well as for the purpose of gaining an understanding about the use of these items in administration.

Table 22 provides details of other ICT equipment currently available for use, based on 104 principal responses. The table shows that computers established in a computer room are the predominant ICT computer configurations, with nearly half of the schools having less than 5 computers available (and about one third having only one or two items available, including 22 schools which have no computers). There are few laptops, with about half having only one or two of them and there are no tablets. About 40% of the schools contacted have no LCD and just over 40% have only one or two LCDs.

Table 22: Current ICT equipment: Principal survey responses

N=104

No. of items of equipment	Computers No. of schools	Laptops No. of schools	Tablet No. of schools	LCD No. of schools	TV No. of schools
0	22	25	104	41	30
1-2	31	49		48	64
3-5	12	25		13	10
6-10	10	4		2	
11-15	4	1			
16-20	14				
21-25	6				
26-30	1				
31-35	1				
36-40	3				

However it is important to note the difference between regencies and schools within regencies. The Jayapura case study conducted for this evaluation, especially in the selected schools visited, indicated some schools having reasonable amounts of equipment. For example, in some of the Jayapura case study locations there were 3-4 laboratories including a laboratory for micro-electronics and with rooms having 30 personal computers and a

number of LCDs projects. Schools are starting to realise that LCDs are one ICT item which has the potential to change pedagogies, with several schools in Merauke having almost one LCD per classroom.

8.1.2 Bring-your-own-device

One way of overcoming financial constraints and ensuring sufficient ICT hardware is to allow students to bring their own laptops and mobile phones to school for use in lessons. In the student survey most students said they were forbidden to bring mobile phone technologies to school and many indicated they could only bring laptops if a teacher requested this. Through interviews and focus groups, the reasons presented on this policy were parents, teachers and principals being worried about equipment going missing, to avoid social jealousy, concern regarding students being disturbed in the classroom, and worry that students would access inappropriate website material.

In the focus groups, those schools permitting students to bring their own equipment indicated that about 40-50% of students did this and equipment was shared between students for positive benefits in learning and in collaboration. Several of the case study schools in Jayapura and Merauke had bring-your-own-device programs operating successfully and through this access, students were about to access the internet in their subjects.

8.1.3 Importance of ICT equipment in working order

Earlier chapters of this report have introduced various infrastructure and hardware aspects relevant to ICT in education in Papua both in terms of TV-E or ICT Centres.

In the main written survey undertaken, both principals and teachers were asked about how important various hardware items or other aspects were to the success of ICT in education. Principals (N= 145) indicated that apart from professional development, a computer lab with hardware in working order was a very high priority, with 65.9% of them indicating this (and with 27.7% indicating this was not important; 6.4% don't know). Similarly, 74.7% of teachers (N=1506) identified the importance of a computer lab. (with 18.4% indicating this was not important; 6.9% don't know responses)

Regarding the importance of a classroom set of computers 58.6% of principals (N=129) viewed this as important and 35.9% did not (with 5.5% indicating don't know responses). Similarly, 55.8% of teachers indicated this was important (38.2% indicating this was not important; 6% don't know responses).

8.2 Finances and plans for ICT

Previous chapters have captured some key aspects about ICT equipment and resources provided to some schools in Papua by the government during the past decade. There are also some schools which have been supported by Yayasan and other organisations. Some schools have accessed ICT through their own funding sources such as school committees or parent contributions.

Principal survey responses (N=214) regarding funding are provided in Table 23:

Table 23: ICT funding sources

Funding sources	Yes %	No %	Don't know %
Indonesian Govt block grants	36.0	48.6	15.4
Papuan provincial govt e.g. BOSDA	50.7	40.0	9.3
Kabupaten	44.3	47.6	8.0
Donor aid e.g. UNICEF	1.0	85.2	13.8
University research	1.9	84.8	1.9
Yayasan	11.4	77.7	10.9
School committee/parent contributions	24.8	66.4	8.9

Indonesian, Papuan and Kabupaten funds were the main funding sources and both public and private schools seemed to access some of these funding streams in various situations. It should be noted that many principals provided 'no' or 'don't know' responses to all forms of funding possibly suggesting unwillingness to answer this question. Another point of interest is for about 25% of schools, school committees and parent contributions are also used for ICT. About 11% of schools are Yayasan funded for ICT.

The size of ICT budgets was generally less than 20,000,000 rupiah for 68.1% of schools and 20,000,000-40,000,000 rupiah in 13.3% of schools. Regarding uses of funds, electricity was the key focus, accounting for 55% of responses, with maintenance costs and internet costs accounting for about 25% each in the principal survey responses. New equipment accounted for only 8.3% of responses and equipment replacement for 18%.

Beyond the source of funds and amounts, of interest was the funding approaches themselves. In the Merauke case study (Appendix E), interviewees in one school indicated that the use of BOS funds was against an allocative model that permitted acquisition of ICT hardware on a restrictive basis: schools could add to their fleet of computers (or laptops/tablets) on the basis of one device per class per year. That is, if a school had 20 classes, it could only purchase 20 devices in its annual ICT purchasing plan

8.3 ICT infrastructure and ICT PD plans

Principals were asked in the survey about whether their schools had an ICT hardware purchasing program and also an ICT Plan. Regarding the former, about 44.7% of principals indicated the hardware purchase plan (49.8% indicated 'no' and 5.5% indicated 'don't know'). Regarding having an ICT Plan, 68.9 % gave a 'yes' response and 27.9% provided a 'no response' indication.

During the focus group visits to twelve schools, some schools indicated that the funds for ICT were captured within a school budget overview plan which in a few cases was displayed prominently in the external area near the school office for wide visibility. However the information was not very detailed and no forward and long term planning was able to be outlined.

Throughout the case studies and focus groups, schools were asked to provide hard copies of ICT Infrastructure and ICT PD plans. In most instances, these were not available as

written documents. In other jurisdictions, the presence of this type of documentation is indicative of sustainable practices and in some instances, it is mandated by authorities.

Four plans were provided to the evaluators, one from an SMPLB (Extraordinary Secondary School) site, two from SMP schools and one from an SMA.

The plans articulated progress in these schools, with larger schools adding more infrastructure items (computer devices, LCD projectors and printers) and the smaller schools generally being more cautious and clearly having smaller budgets. One school had a very clear plan to prepare a Teacher Task Team and a Master Plan for infrastructure and PD. It had started to develop a Learning Management System based around Moodle and Edmodo. Some of these schools had dedicated ICT teachers and technicians, with some having a dual role. The SMA school visited was already a centre for district ICT PD and was to become a testing centre for Principal Competency in the future.

The content of these plans is analysed in Table 24. It appears that for some of these schools, planning is having an impact on some of the issues that have been noted elsewhere in this research, in particular lack of hardware and professional development.

Table 24: ICT plans

	Currently available				In 2015 Budget plan for purchase		
	# of computer devices	# of LCDs	# of other ICT devices	PD Plan	# of computer devices	# of LCDs	# of other ICT devices
SMPLB (student population =22)	3	0	1 camera	No	10	0	0
SMP 1 (student population =170)	18	1	1 camera	No	70	10	2 cameras
SMP 2	45	3	3 cameras	Yes	36	4	5 printers 1 scanner
SMA	36	20	5 cameras	Yes	135	0	Software for multi-media

Generally looking at the detailed information from some of the case study schools, schools with well-documented ICT Plans appear to have better access to ICT for students, with more computer devices available and weekly scheduled lessons involving practical work being evident.

8.4 Supports and challenges

Surveys, focus groups and interviews indicate the value of ICT but also the significant challenges faced by schools. Students, teachers and principals were all emphasising the lack of funds to purchase sufficient computer hardware, the issue of power shortages, the high internet costs, and issues of internet unreliability or lack of internet availability as challenges. In the focus groups, many principals also talked about issues of maintenance where equipment provided in the past by other agencies was inappropriate for the local context or an equipment part was broken and not able to be replaced. Lack of technical skills in the school and in some regional and remote communities was an issue. Theft of

equipment or wilful damage was another challenge raised. A reason occasionally given in principals interviews for not purchasing laptops or tablets or for not permitting students to bring their own equipment from home to use at school seemed to involve concerns about security of items. In Jayapura focus groups, the issue of insufficient power or frequent power outages was raised and the local power supplier had been contacted about this.

Students in their open response questions indicated a preference for using ICT and internet to gain easier access to information and knowledge building and for faster learning. However, the majority of responses were about the general ICT challenges such as no computers or no ICT or lack of power, damaged equipment, frequent power outages, absence of teachers and rules forbidding bringing of mobile phone technologies and laptops to school.

Figure 7 shows some broken computer equipment which typifies many locations visited during case studies.



Figure 7. Broken computers

Despite these challenges, a number of positive supports were available including school committees and parent contributions and partnerships with local businesses and NGOs.

The importance of school committees or parent contributions in funding hardware such as computers and laptops or internet access needs emphasis. While this only seemed to occur in about 25% of surveyed schools, the focus groups and case studies indicated various approaches. For example, in the Nabire case study, a teacher laptop purchase program operated in one school through the School Cooperative (Koperasi sekolah), with a credit facility available. Several schools had parent committees which met regularly regarding ICT and also provided finance for equipment. Students in one school were paying 70,000 Rp per month for equipment and internet. More details are provided in Appendix E.

Partnerships with businesses were benefitting schools especially in Jayapura. Examples relevant to some of the schools included partnerships with banks, telcos and car dealers. The local airbase supported the Department of Aviation Engineering in one school. Future plans included further entrepreneurial activities underway in several of the schools to improve internet connection. Another plan outlined by one school was concerned with opening a Department of Computing and Networking. One school plans

to open a business unit as an ICT training center for companies and other institutions at Jayapura. Appendix E contains details.

8.5 Summary

This chapter has focused on the hardware, maintenance, planning and funding supports and challenges.

Some key findings have been presented.

- 68.1% principals indicated spending less than 20,000,000 rupiah per year; 13.3% spent 20,000,000 to 40,000,000 rupiah.
- 55% principals indicated spending mostly on electricity; 20% indicated significant spending on internet costs and also on maintenance of equipment, with there was minimal funding for new equipment and replacement of equipment.
- 24.8% of principals had school committee/parent contributions towards ICT ; 11.4% have Yayasan funds.
- 44.7% of principals indicated having a hardware purchase plan; 68.9% had an ICT plan and some detailed plans have been examined, although generally these were not frequently available when requested in case study and focus group situations.
- Responses from 104 principals about current equipment indicated nearly half of the schools having less than five computers available (and about one third having only one or two items available, with 22 schools having no computers).
- Current availability of equipment indicates little access and relatively high student to computer ratios, with few laptops (about half have only one or two of them and no tablets). About 40% of schools have no LCD and just over 40% have only one or two LCDs.
- Principals indicated a computer lab with hardware in working order was a very high priority, with 65.9% of them indicating this and with 74.7% of teachers.
- 58.6% of principals (N=129) indicated a classroom with computers was important and 55.8% of teachers.
- Few detailed ICT purchase plans were evident and those schools purchasing items in a systematic manner were doing so at the rate of about one or two items per year and have been done according to BOS funding requirements.

The value of well-documented ICT Plans is highlighted, with these schools having better access to ICT for students, with more computer devices available and with students accessing weekly scheduled lessons involving practical work.

Chapter 9: Professional development for ICT

A key aspect which is a focus for this evaluation and research area 2 and is about examining implementation issues and how the ICT skills of educators and principals have been developed to ensure their readiness for TV-E and other ICT in education programs. This chapter outlines professional development for ICT encompassing national, provincial, regency/Dinas Pendidikan and school level responsibilities. The role of universities and KPGs is also explored, both in terms of preparing student teachers for their future careers of teaching in a futures-oriented ICT world and in terms of supporting the ongoing professional learning of teachers.

9.1 Professional development contextual issues

9.1.1 ICT and professional development context

The importance of professional development occurring to skill teachers in ICT was raised in the literature section of this report in Chapter 1. Beetham and Sharpe (2013) indicate that this involves targeted professional development addressing specific issues of concern to teachers. Differentiated support which is classroom focused is also needed and seeing other teachers modelling effective learning with ICT in the classroom, as well as having access to a range of technology (Tomlinson & Allan, 200). Werang et al's (2014) research in the Papuan context in Merauke highlights the importance of improving the quality of student learning outcomes through teacher professional development. Digital professional learning has been highlighted as a way of meeting the needs of teachers in remote communities (Burns & Bodrogini, 2011). Timperly (2007) has highlighted the importance of moving beyond attendance at conference events led by experts and also including ongoing opportunities for continuous learning with peers in the school environment, with Pradhan & de Ree (2014) emphasizing the value of teachers frequently working together. Mentoring and coaching are an important part of this, as well as modeling of alternative practices and providing evidence of improved student learning.

One of the evaluation focus areas is professional development implementation and how the ICT skills of educators and principals have being developed to ensure readiness for TV-E and other ICT in education programs.

In the 2010-2014 Implementation Strategy, professional development was highlighted as a key aspect in regard to relevant staff developing the technical and management skills needed for operating school based ICT and also in building the ICT leadership skills of principals and basic computer skills of teachers. The role of Teacher Education Institute staff in supporting the professional development activities was also highlighted.

The UNESCO framework and MoEC *ICT Competency Framework for Teachers* (2011 and 2012 respectively), as outlined in Chapter 1, outlined ICT phases of Literacy, Knowledge Deepening and Knowledge Creation (also for the 2012 framework, Knowledge Sharing). Domains of Policy, Curriculum and assessment; Pedagogy; ICT; Organisation and Administration, also Professional Development, were also included in each of these associated frameworks. Given the 2010-2014 implementation strategy and focus on basic computer skills of teachers, the focus for ICT professional development does seem to have been at the early phase level of 'literacy'. The MoEC (2012) framework indicates that this is

about understanding policy, designing learning activities using ICT tools; using ICT to explore PBL and for individual development or collaborative work at the basic level; supporting students to use various software, internet and using ICT for administration; using ICT for basic management and identification of PD needs and online learning communities using ICT. The more advanced levels of the competency framework are about using ICT for authentic learning and for participating in online professional communities or using multimedia for improving student creativity and innovation.

Without a doubt, the surveys and focus groups do indicate that teachers are aware of the need for professional development to help them to develop their skills. About 86.8% of principals and 88.7% of teachers indicated in the survey that they valued professional development as essential to ensuring the success of ICT in education.

Provincial, regency/district and school-based activities regarding support provided for professional development will now be outlined.

9.1.2 ICT professional development at the provincial level

Regarding professional development which has occurred to support ICT programs at the provincial level, the role of Pustekkom and BPP in TV-E and other programs has already been outlined in Chapter 4 of this report.

Survey responses from principals and teachers indicated quite positive responses to the professional development provided in regard to TV-Edukasi, Portal Rumah Belajar, SEA Edu-Net, School Net, Jardiknas and ICT Centres. About 97% of principals who accessed TV-E professional development and about 95% of teachers were indicating its value. There were minimal negative responses about the professional development offered for various ICT programs.

In terms of the TV-E professional development (PD) offered being successful in improving principal leadership skills or teacher skills in using ICT for student learning, Table 25 provides details of principal responses.

Table 25: Principal view re TV-E PD and impacts on leader skills and on teacher skills

N=111

	To a great degree %	To some degree %	Not at all %	Don't know %
Development of leadership skills in using ICT for student learning	43.2	27.0	10.8	18.9
Teachers development of skills in using ICT for student learning	36.9	33.3	9.0	20.7

As shown in Table 25, about 70% of principals were indicating that they believed the TV-E professional development did have an impact on their own leadership skills and those of teachers in terms of using this type of ICT for student learning.

9.1.3 Dinas Pendidikan and school-based professional development

Beyond province coordinated professional development programs and roles undertaken by Pustekkom or BPP for example in the TV-Edukasi training of principals and teachers associated with that program, the role of regency and district authorities in professional development in the past has not appeared to be clearly identified. As indicated in previous chapters, there do not appear to have been clear roles indicated for regencies and districts in previous strategic plans associated with ICT programs. While there have been some indications in the past of regencies and districts voluntarily taking on responsibilities, this has not always been followed through such as in the Keerom digital learning process undertaken in partnership with universities.

In interviews with Dinas Pendidikan officials for the current evaluation, there were indications of professional learning being supported at the district level such as through subject or principal communities of practice groups which met regularly or through provision of some financial support or coordination for Masters level studies (with distance learning involved increasing participant ICT skills). Some Dinas Pendidikan officials were providing laptops for school leaders or staff or were planning to do this in the future, sometimes with demonstration of competence required within a particular timeframe.

Certainly in the focus groups many staff from SMP contexts were indicating that they valued the subject specific communities of practice sessions in their districts (MGMP), and principals also found their ongoing meeting groups (MKKS) beneficial to deal with a range of issues of which ICT was one aspect. However in some districts these groups were not operating currently.

In the focus groups, what seemed to be the key focus for provincial and regency authorities were the priority areas which had professional development implications. These areas including ensuring training of various personnel for administrative data collection tasks associated with national exams for students, teacher online competency testing or other record keeping aspects requiring training of district office staff.

9.2 School level ICT professional development

Considering the school context for professional learning, in the interviews/focus groups and case studies conducted for this evaluation, there was minimal indication of schools providing ongoing professional learning for teachers to improve their skills in ICT. Only some schools have specialist ICT teachers and a minority of schools indicated that they sometimes held whole staff sessions about particular ICT skills, especially if a key person had been to a province-led session or to a national event.

During focus group and case study interviews, schools were invited to provide their professional development plans. Of the schools visited, few had plans about PD committed to paper. Some schools' plans were part of the RKAS and some were not.

Two schools provided hard copy and these are summarised in Table 26 and Table 27:

Table 26: School 1 ICT PD plan

Target audience	Equipment needed to complete ICT PD	Activity
<ul style="list-style-type: none"> Teachers, students and administration staff 	<ul style="list-style-type: none"> Laptops Computers Tablets LCD projector 	<ul style="list-style-type: none"> Completing online data of teachers such as DAPODIKMEN, PADAMU NEGERI KEMDIKBUD Teacher training in using the ICT learning process Reporting school administration, especially the using of BOS and BSM (online) Completing students selection to enter a university (online) ICT class School administration

Table 27: School 2 ICT PD plan

Target audience	Equipment needed to complete ICT PD	Activity
<ul style="list-style-type: none"> Teachers (task team for school planning) Teachers (class based PD) 	<ul style="list-style-type: none"> Computers Laptops Tablets 	<ul style="list-style-type: none"> Developing school ICT and ICT PD plan How to design a multimedia presentation Using Moodle Using weblogs Utilising a Learning Management System (LMS) Developing a virtual class website PowerPoint to Flash Articulate presenter (online and mobile course development)

In examining Table 26 and Table 27, it is interesting to note that the first school is very focused on administration in the professional development activities while the second school is more focused on both classroom and administration work.

Generally, in the case studies and focus groups conducted for this evaluation, it was evident that principals believed that formal professional development was the responsibility of the government and not of schools. For example, similar to other contexts, in the Jayapura case study there was no budget for teacher training, workshops or seminars. Similarly, school committees did not support professional development for teachers. The principal network (MKKS) and teacher network (MGMP) were no longer active. Generally teachers indicated in the focus groups and case studies that they learned from each other, from parents or they learned new ICT skills by themselves.

Some schools were supporting staff ICT skill-building through encouraging teachers to purchase laptops for themselves or schools had cooperatives so that payment could occur over a longer timeframe. Teachers indicated that having a laptop was very beneficial for preparing their lessons and sometimes teachers were taking their own equipment to school to use in the classroom.

9.3 Universities and KPG

For this evaluation, interviews were held with representatives from two Papuan universities and two KPGs in various capital cities and regional locations. Questions were asked about the role of the institutions in supporting ICT professional development for current teachers and also in preparing the teachers of the future for ICT rich classrooms.

In the survey of principals and teachers, they indicated little professional development happening through universities. University and KPG interviewees also reported little involvement in professional development associated with ICT programs such as TV-Edukasi. There had been a few staff from one institution who were involved in helping with ICT Centres and professional development for teachers. They indicated that teachers attending PD were unable to practice when they returned to their own schools after training in ICT because they had no access to equipment. But the main issue becoming evident in university discussions was that the institutions themselves have few ICT facilities and few staff who are ICT literate, particularly in terms of the pedagogical practices and benefits of using ICTs. Currently, there are only some university and KPG facilities with LCDs in the rooms. Computer laboratories in working order were not always available and many institutions in regional locations did not have internet access. While some of the institutions are planning to improve their facilities in the future and may be able to support the ongoing professional learning of teachers, this is not the case at the current time to any great extent.

Most institutions also recognise that it is important to have student teachers learning about and using ICTs so that they are prepared for their future classroom role. However, there was little evidence of any ICT skill building occurring on a systematic basis, with some students essentially bringing their own laptops to classes and using these while teaching themselves new skills or learning from other students.

The Merauke case study did indicate one private university which was conducting an outreach program to support teacher professional development. It had established an ICT Centre of Computing and was indicating its commitment to producing graduates with ICT skills through embedding two ICT-specific courses in its program through embedding two ICT specific courses in its programs.

9.4 ICT pedagogy

The real issue across Papua is that for teachers and student teachers alike, the evidence indicates that students are mostly doing Microsoft Office. There is also some evidence which exists to show that there is almost no professional learning activity occurring beyond narrow skill building in Microsoft Office. The focus here is on Microsoft Excel spreadsheets for administration purposes or on Word for classroom lesson preparation and perhaps some focus on accessing of the internet for resources. These types of activities reflect the 'Literacy' level of the *ICT Competency Framework for Teachers*, rather than the focus on multimedia and authentic learning and students working collaboratively. There were some good examples in the case studies, especially in SMK schools where students were using professional equipment and creative software programs for their learning. However, there was no evidence of reconsideration of pedagogy and the potential afforded by ICT to really build the skills of students as independent, creative and collaborative learners being prepared for 21st century work and life, as indicated in the competency frameworks.

Survey data has provided some ideas about how Papuan students prefer to learn. In the open responses, it was strongly suggested that there is a preference to have practical

lessons in ICT as opposed to learning from the book. Unpublished work (Hyde, USC nd) has suggested that this is the case and that Papuan students are more inclined to respond to visual-spatial experiences (active engagement) as opposed to didactic-auditory activity (passive receipt of knowledge).

Additional research in this area can be drawn from the 'Educability Study' (Toisuta, nd) which provides a set of pre-conditions to optimise learning for Papuan students:

... the educational approach that considers all children in Indonesia as identical, is wrong. To consider all children equally is generally demonstrated by methods of learning that impose 'curriculum' and learning methods are uniform. This then makes achieving quality education difficult. In understanding Keterdidikan (educability), it is recognised that all children are different, they require a diverse set of curriculum, and different methods for different learning (differentiation). If the approach is adapted to the conditions (keterdidikan) this can push the learning capacity of children to the optimal level and meet quality standards that are universal.

Productive Pedagogies (State of Queensland, Australia) may be considered as a possible approach that supports student learning through differentiation. Productive pedagogies provide a balanced theoretical framework which enables teachers to reflect critically on their work. Teachers usually use the Productive Pedagogies framework to consider:

- Are all the students I teach, regardless of background, engaged in intellectually challenging and relevant curriculum in a supportive environment?
- How do my teaching and assessment practices support or hinder this?
- What opportunities do I have to critically reflect upon my work with colleagues?

The manual that outlines these 'pedagogies' can be used to assist teachers to:

- Reflect on current classroom practices
- Generate a professional language
- Design curriculum and learning experiences
- Make intelligent decisions about individual students' needs.

Table 28 provides further details of the approach.

Table 28: The productive pedagogies framework

Intellectual quality Higher-order thinking Deep knowledge Deep understanding Substantive conversation Knowledge as problematic Metalinguage	Recognition of difference Cultural knowledge Inclusivity Narrative Group identity Active citizenship
Supportive classroom environment Student direction Social support Academic engagement Explicit quality performance criteria Self-regulation	Connectedness Knowledge integration Background knowledge Connectedness to the world Problem-based curriculum

Each of the domains in Table 28 holds a message to all educators, regardless of culture. Whilst this framework was developed for another jurisdiction and context, there are many messages to be taken by Papuan teachers about aspects such as connectedness to the world, knowledge integration, student direction of learning and explicit quality performance criteria.

Another approach from Papua which provides a way of supporting teachers to use a wider range of pedagogies, is the Open Lesson Plan Model which has previously been used in the Keerom ICT Study in regard to improving mathematics and science teaching in SD schools.

In this approach, a lesson study (lesson plan) model of developing lessons and learning episodes around a three stage model is used. Its purpose is to increase quality education, deriving from Japanese research, *Jugyou Kenkyuu*. Lesson study can be applied to various learning renewal contexts based on the situation, conditions and problems faced by teachers. It has three discrete phases: planning (*plan*); implementation (*do*); reflection.

In the planning stage (*plan*) to design-centered learning, teachers collaborate in planning learning activities. In the second step (lesson study or *do*), teachers implement lesson plans, whilst colleagues make observations of the lesson unfolding. Learning is open, hence the use of the term *open lesson*. In the final or third phase (reflection), the lesson is discussed and critiqued by the planning team: what worked and what could be improved. Learning is seen as a cyclical and a continuous improvement model is created. This leads to improvement in quality over time (Agus & Liliyasi, nd).

9.5 Summary

This chapter has focused on professional development for ICT.

- Professional development is rated as important for increasing ICT success in education by 86.8% of principals and 88.7% of teachers.
- About 97% of principals and 95% of teachers indicated TV-E professional development was valuable, and similarly for other ICT programs like Portal Rumah Belajar.
- Approximately 70% of principals are indicating that they believe the TV-E professional development did have an impact on their own leadership skills and those of teachers in terms of using this type of ICT for student learning.
- Few schools have ICT PD plans and budgets, and generally principals believe this is the responsibility of government.
- Most ICT professional development for teachers occurs through individual efforts or peer learning.
- Inadequate school based or regency/district based ICT professional development is occurring.
- Universities and KPG have little ICT infrastructure and almost no focus in pre-service teacher programs on ICT pedagogy and skill building.
- There is very little focus on pedagogical practices associated with ICT.

The evidence indicates that there is a need for more specialist workshops to skill teachers and leaders in the pedagogical practices involving ICT and reflecting the more advanced phases of the ICT competency frameworks. More ongoing networking and establishment of school-based and district communities of practice are also needed to support the development of new teaching practices involving ICT.

The evidence also suggests there is an urgent need to ensure universities and KPG have the infrastructure, staff and pedagogical practices to prepare the teachers of the future for technology-rich classrooms.

Chapter 10: ICT impact on teacher and student learning

The previous chapters outlined the policy, educational, professional development and infrastructure contexts for ICT in Papuan schools, as well as the evaluation findings in terms of surveys, interview/focus groups and case studies. This chapter outlines the impact of ICT on teacher and student learning, focusing on the third and final question about the impact of various ICT processes and practices on student and teacher learning.

10.1 Introduction to success indicators for teacher and student learning

Background literature outlined in Chapter 1 indicated the difficulties of making direct links between ICT and student learning outcomes, although there are some indicators and research which are relevant to teacher learning. Some research (Tamin et al, 2011; Means, 2010; Means et al, 2013) has shown marginal gains for student outcomes especially where blended learning involving some face-to-face and some online learning is involved. OECD PISA data has also indicated that where students are accessing technology at home on a regular basis, then school achievement results seem to be higher (OECD, 2011). Pedagogical advantages of ICT for teacher and learning are evident in developed and developing countries (Beetham & Sharpe, 2013), with a wider selection of resources and teaching strategies and the value of collaborative networking has also been highlighted (Zittrain, 2008).

Trinidad et al. (2005) have also indicated, teachers need sustained professional learning in teaching and learning in ICT including skills such as undertaking online searches, validation of content, and publishing. However of equal significance is the importance of technological and pedagogical knowledge to enable technologies to be meaningfully integrated with classroom practices (Mishra & Koehler, 2006). This relates to the issue of ensuring student learning beyond achievement scores such as a wider range of learning in regard to the 21st century skills of communication, collaboration and creativity (Partnerships for 21st Century Learning Skills, 2008). The twenty first century pedagogies usually involve a different teacher-student relationship and changes to the role of the teacher, with teachers and students working as co-learners and learning from each other (Harasim, 2012; Siemens, 2004).

Regarding teacher learning, the previous chapter and others in this report have highlighted some attendance of individual Papuan teachers and leaders at training events led by experts or for train the trainer purposes. Little ongoing formally-organised school-based and district-based professional development focused on ICT is evident. Instead, in Papuan schools, while teacher peer learning is predominant and beneficial, more structured opportunities for learning from each other and continually working together and supporting each other in building skills in a school-based community of practice is not evident. This is despite research highlighting the benefits of ongoing opportunities for continuous learning with peers in the school environment to really embed the learning of new skills and change practices. The importance of ongoing support for ICT as skills are being developed can be related to Bingimlas (2009) research. This research has identified key barriers to teachers learning to use technology including lack of technical support and infrastructure but also poor teacher confidence and competencies and resistance to change and negative attitudes.

10.2 Teacher and principal learning impacts

Based on the literature, teacher learning in regard to ICT is likely to depend on their beliefs about its value, and their sense of confidence about ICT as a precursor to further growth in skills. Principals and teachers being able to identify their learning from ICT is another aspect which will be outlined in this section of the report.

10.2.1 Teacher and principal beliefs about ICT value for learning

In the survey, principals and teachers were invited to respond to questions about the value of ICT for learning. Responses were sought about whether learning with computers is fun, whether ICT is good for learning and whether ICT helps students to work collaboratively and develop creativity and good communication skills. Also, responses were sought about whether teachers and principals perceived that computers helped them to learn new things.

There were highly positive survey responses in regard to all of these areas and indicating there were strong beliefs about the value of ICT for learning. Indeed, over 95% of respondents provided 'strongly agree' and 'agree' responses to most of these questions (and about 90% for ICT's value in improving student communication skills). Male and female teacher and principal responses were similar and there were no significant differences for regencies or age. Table 29 provides details regarding whether computers are necessary for learning.

Table 29: Computers as a necessary tool for learning: Principal/teacher responses

	Principal N=220		Teacher N=1505	
I think computers are a necessary tool for learning	58.9	37.0	45.5	48.3

In another associated question seeking information about whether teachers and principals had negative attitudes towards using ICT, there was only about a 1% negative response rate.

10.2.2 Teacher and principal ICT capability

To ascertain capability, teachers and principals provided self-ratings indicating varying levels of ICT skills capability as shown in Table 30a, 30b, 30c and 30d:

Table 30a. Principal and teacher self-rated ICT capability

Principals N=220; teacher N=1495

	Very capable Principal %	Teacher %	Capable Principal %	Teacher %	Not at all capable Principal %	Teacher %
All	3.2	9.4	20.9	47.9	75.0	41.5

Table 30a shows that considering all responses, about 47.9% of teachers rated themselves as capable (and 9.4% indicated very capable), while for principals only 20.9% rated themselves in the capable group (and 3.2% in the very capable). About 75% of principals indicated they were not at all capable, compared to 41.5% of teachers.

Table 30b. Principal and teacher self-rated ICT capability

Principals N=220; teacher N=1495

	Very capable Principal %	Teacher %	Capable Principal %	Teacher %	Not at all capable Principal %	Teacher %
Gender						
Males	3.6	12.1	23.2	47.7	72.6	39.0
Females	1.9	7.6	13.5	48.0	87.7	43.2

Table 30b indicates that there were gender differences, with males generally rating themselves as more capable than females for both the principal and teacher respondents. Males generally rated themselves as more capable than females for both the principal and teacher respondents. About 72% of male principals and 39% of male teachers rated themselves as 'not at all capable' but for females this rating was higher at 87.7% of principals and 43.2% of teachers.

Table 30c. Principal and teacher self-rated ICT capability

Principals N=220; teacher N=1495

	Very capable Principal %	Teacher %	Capable Principal %	Teacher %	Not at all capable Principal %	Teacher %
Age						
19-25	0	10.7	50	68.5	50	20.8
26-34	25.0	11.5	12.5	52.0	62.5	35.6
35-44	5.6	8.4	24.1	45.1	68.5	42.2
45+	1.3	7.9	20.1	37.7	77.9	51.6

Generally also, younger teachers and principals rated themselves more highly in terms of their capabilities as Table 30c displays.

Table 30d. Principal and teacher self-rated ICT capability by location

Principals N=220; teacher N=1495

	Very capable Principal %	Teacher %	Capable Principal %	Teacher %	Not at all capable Principal %	Teacher %
Location						
Urban	1.8	8.9	20.9	52.3	75.5	38.1
Peri-urban	4.5	8.7	25.4	45.0	70.1	44.3
Remote	4.7	1.3	14.0	35.3	81.4	50.2

Table 30d shows the locational differences. About 81.4% of principals in remote locations rated themselves as 'not at all capable'. About half of the teachers in remote locations also rated themselves as 'not at all capable' (compared to 38.1% of remote location teachers).

Further information about teacher and principal capability and associated levels of ICT confidence can be gained from other questions in the surveys regarding perceptions about whether computers are difficult to understand, whether they are frustrating and whether ICT causes nervousness. About 30% of principals and teachers indicated some sense that computers are difficult to understand and created nervousness and about 20% indicated computers are frustrating.

About 95% of principals and teachers indicated that they need to have good ICT skills themselves before students use the technologies. This information reflects a traditional approach to teaching based on teachers as experts, rather than teachers as co-learners with students. Given the capability self-ratings from many principals and teachers, there is much professional development work and pedagogical practice to be reconsidered. To enhance self-confidence and capability of teachers as a precondition to students increased use of ICT in schools, this PD needed to be based on a needs analysis and differentiation to cater for varying participant learning needs.

10.2.3 Impact of ICT on teacher and principal learning

Principal and teacher survey responses about whether ICT helps them to learn were very positive with 96.3% of principals and 97.9% of teachers strongly agreeing or agreeing about this.

The open ended response in surveys and focus group and case study information consistently reinforced the positive impact of ICT on teacher learning. Principals and teachers gave many examples about the expansion of their knowledge through having access to information on a global basis through news, sport, religious and knowledge services, as well as widely through all the various sites available on the internet. The key areas of learning related to expansion of teacher knowledge through accessing a wider range of resources; learning about new teaching approaches and also gaining a deeper understanding of issues through connecting with other colleagues through online processes, were aspects raised.

Example comments which reflect some of the benefits perceived by teachers and principals are:

- ‘educational TV adds insight, knowledge’
- ‘easy to obtain materials, more effective time, teachers will be better prepared’
- ‘provides insight and knowledge resources that were previously unknown to me.... a source of fun learning’
- ‘helped to make sense of the information or material that is taught, helped get new information, exchange information with colleagues’
- ‘more easy for teachers to teach together. There is a real example of what they see to provide further encouragement for teachers to know new things’
- ‘facilitate the learning process in class...student interest and proper delivery of subject matter’
- ‘very useful for us because of the limitations that we experience, with this program allowing us to know new things’.

Summarising this information about teacher learning, there are positive signs that teachers and principals are learning from ICTs and they generally have positive beliefs about ICT’s value for their own learning and that of students. However many teachers and in particular principals and especially those in remote locations do not rate their skills highly. There is considerable professional development needed, which is supported by ongoing access to ICT and an expectation that teachers and principals are using the technologies as teachers work with students in the classroom.

10.3 Student learning impacts

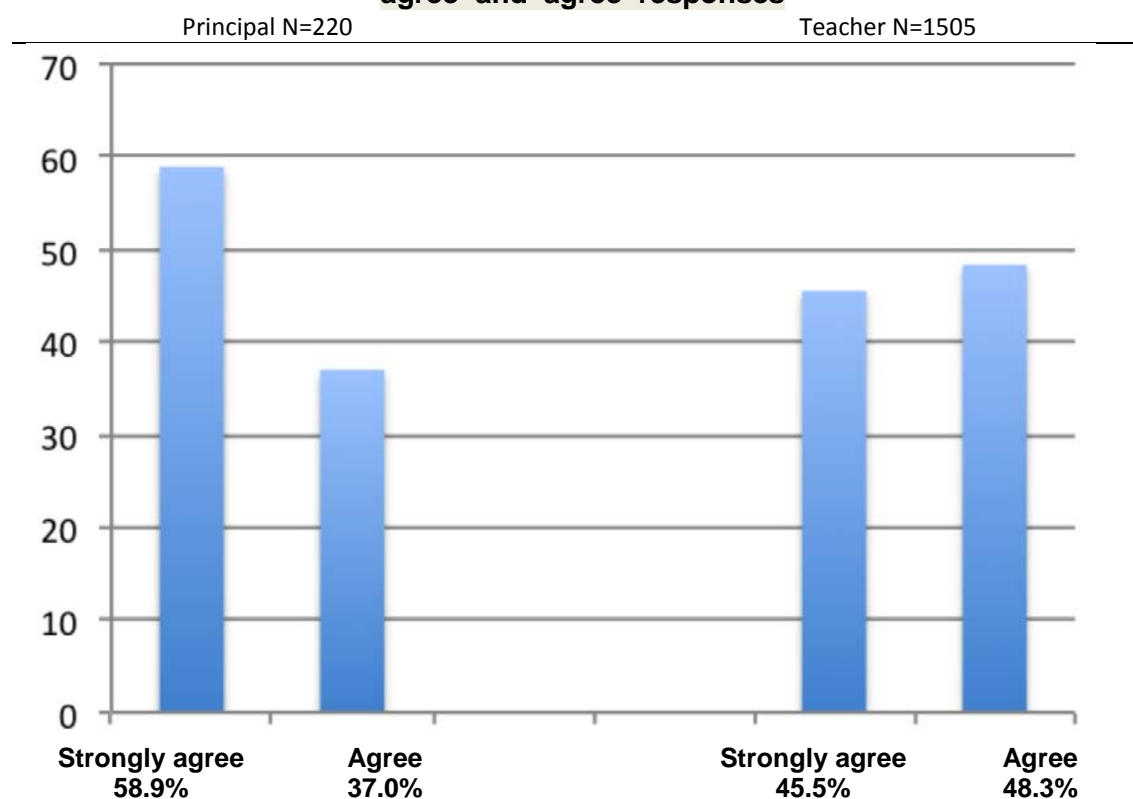
Based on the literature, student learning in regard to ICT is likely to depend on their beliefs about its value, and their sense of confidence about ICT as a preliminary to further growth in skills. Students, as well as teachers and principals indicating ICT learning by students is another aspect which will be outlined in this section of the report.

Students and parents in focus groups also expressed strong views about the value of ICT for learning and gave examples in their responses of improved achievement, social skills learning, creativity and increased communication skills and independent learning.

10.3.1 Student beliefs about ICT value for learning

Students in the survey were asked various questions about learning at school including whether they believed access to ICT at school helped them to learn.

There was a strong positive response with 71.1% of students (N=3124) indicating ICT value with a strongly agree/agree response as shown in Table 31. There were negligible responses indicating this was not the case. Essentially all other responses indicated no access to ICT at school (17.8%) or ‘don’t know’ (8.5%). The no ICT access at school response was especially evident in Supiori (70.4%), Lanny Jaya (42.8%) and Deiyai (32.7%).

Table 31: Student learning impacts from ICT: Principal and teacher ‘strongly agree’ and ‘agree’ responses

10.3.2 Student ICT capability

Students in the survey provided self-rating about their ICT capabilities. Table 32 provides results.

Table 32: Student self-rated ICT capability

N=3024 *

Students N=3116	Very capable 11.4%	Capable 41.7%	Not at all capable 43.9%
Location			
urban	13.9	51.3	31.4
peri urban	8.1	38.1	52.0
remote	10.2	22.0	64.4
Gender			
Male	11.6	41.6	43.9
Female	11.3	41.8	44.9
Grade			
Grade 5	11.1	29.9	53.3
Grade 6	12.7	32.9	50.1
Grade 7	11.9	47.8	45.1
Grade 8	11.2	55.5	32.1
Grade 9	10.2	52.0	34.0

* excludes 'I do not like ICT' responses

Table 32 shows that considering student responses in general, 11.4% of students rate themselves as very capable and 41.7% as capable, with 43.9% indicating 'not at all capable'. Gender differences are not evident. Students in senior classes rate themselves as very capable or capable more than students in grade 5 and lower classes, and their 'not at all capable' responses show less students in senior classes providing this response. Of particular interest are the location differences, with urban students about twice as likely to rate themselves as capable or very capable compared to remote students.

10.3.3 Impact of ICT on student learning

In the principal, teacher and student surveys and in focus groups with principal, teachers, student and parents, questions were asked about the impact of ICT on student learning. In all of these contexts, responses were generally strongly positive. The types of impacts cited were about achievement, social learning, knowledge building and creativity, as well as about the development of students' independent learning skills.

Table 33 provides details of principals' and teachers' strongly agree/agree responses about ICT impacts on various types of student learning.

Table 33: Student learning impacts from ICT: Principal and teacher responses

	Principal N=220		Teacher N=1505	
	Strongly agree %	Agree %	Strongly agree %	Agree %
I think computers help student to work collaboratively	34.1	54.1	35.2	54.9
I think computers allow students to develop good communication skills	36.8	54.5	41.2	50.8
I think using ICT develops creativity in students	44.1	50.0	46.7	48.6
I think computers are a necessary tool for learning	58.9	37.0	45.5	48.3

As shown, both principals and teachers are rating student impacts from ICT very highly at around 90% or more for skills of collaboration, communication, creativity and for learning.

Similarly in more detailed open ended survey response, principals and teachers were highlighting increased knowledge building for students because of easier, more visually-appelling and quicker access to information and deeper understanding. Additionally impacts cited were about increased student achievement, and about students being more creative and being independent learners. Example comments about the benefits of ICT for learning, often in conjunction with teacher processes are:

- 'students themselves can search for learning materials and can learn by themselves through the medium of ICT'
- 'increased student achievement'
- 'Increases the ability and creativity of the students in the use of ICT'
- 'easier for students to understand the learning material provided by the teacher in the classroom'
- 'students enthusiasm and passion when...scheduled to watch TV-E'

- ‘students gain additional knowledge and broaden horizons and thinking patterns.. makes student active and creative’
- ‘this program we believe is a useful reference material for our students who live inland...(usually) rely on the book as a source’
- ‘very positive in the learning process because it uses the appropriate image of the subject taught at the time’
- ‘students are more active and happy in the process of learning in class. In addition, many sources of knowledge is seen...by means of this educational TV’
- ‘with the mini ICT Centres, teachers and students will gain knowledge in the field of ICT in particular and other information for the development of students’ knowledge’.

10.4 Summary

This chapter has focused on ICT and its impact on teacher and student learning

Some of the key findings are:

- over 95% of respondents provided ‘strongly agree’ and ‘agree’ responses to most of these questions (and about 90% for ICT’s value in improving student communication skills).
- 47% of teachers rated themselves as capable (and 9.4% indicated very capable), while for principals only 20.9% rated themselves in the capable group (and 3.2% in the very capable).
- About 75% of principals indicated they were not at all capable, compared to 41.5% of teachers.
- Males generally rating themselves as more capable than females for both the principal and teacher respondents. 72% of male principals and 39% of male teachers rated themselves as ‘not at all capable’ but for females this rating was higher at 87.7% of principals and 43.2% of teachers.
- Generally younger teachers and principals rated themselves more highly in terms of their capabilities. There were also some locational differences with 81.4% of principals in remote locations rating themselves as not at all capable. About half of the teachers in remote locations also rated themselves as not at all capable (compared to 38.1% of remote location teachers).
- About 30% of principals and teachers indicated some sense that computers are difficult to understand and created nervousness and about 20% indicated computers are frustrating
- About 95% of principals and teachers indicated that they need to have good ICT skills themselves before student use the technologies
- Principal and teacher survey responses about whether ICT helps them to learn were very positive with 96.3% of principals and 97.9% of teachers strongly agreeing or agreeing about this.
- There was a strong positive response with 71.1% of students (N=3124) indicating ICT value using a strongly agree/agree response. There were negligible responses indicating this was not the case. Essentially all other responses indicated no access to ICT at school (17.8%) or ‘don’t know’ (8.5%). The no ICT access at school response was especially evident in Supiori (70.4%), Lanny Jaya (42.8%) and Deiyai (32.7%).
- 11.4% of students rate themselves as very capable and 41.7% as capable, with 43.9% indicating ‘not at all capable’. Gender differences are not evident. Students in senior classes rate themselves as very capable or capable more than students in grade 5 and lower classes. Of particular interest are the location differences, with urban students about twice as likely to rate themselves as capable or very capable compared to remote students.

- Both principals and teachers are rating student impacts from ICT very highly at around 90% or more for skills of collaboration, communication, creativity and for learning.

Learning impacts for ICT for teachers and students were evident in the surveys and focus groups in terms of capability ratings, valuing of ICT and citing learning occurring. There were differences in self ratings of capabilities for teachers and principals, for females and older teachers and principals, as well as for those remote locations, all of whom gave lower self-ratings about ICT capability Targeted PD is needed.

Valuing of ICT for learning was strongly evident for all participants. This positive response provides a platform for moving forward with planning future strategies for ICT in programs for the future.

Chapter 11: Summary

The previous chapters outlined the ICT programs, research methods and findings relevant to this evaluation. This chapter brings together all of the findings and reconsiders the objectives of these ICT programs, the financial aspects and outcomes achieved, as well as examining the research questions and key findings.

11.1 ICT program purposes

This evaluation focused on TVE-Edukasi and other ICT programs such as Portal Rumah Belajar and School Net/Jardiknas. Other ICT programs of interest have related to ICT Centres and locally-based programs such as the university-partnered *Digital Learning for Teachers Professional Development*, ICT for non-formal education in Community Learning Centres, and South East Asia Education Network (SEA Edu-Net). The overall objectives of the evaluation are focused on understanding infrastructure aspects and their reach, uncovering systems implementation processes and their effectiveness and on determining the impact of various ICT initiatives on the learning outcomes of school children and adult learners throughout the Province

The purposes of the various ICT programs, the TV-Edukasi and other online resources programs were designed to redress the situation which exists in regard to a lack of educational materials in many Papuan schools. The specific purpose of the ICT Centres has similarly been about providing greater access to quality digital online materials. The ICT program component activities, as outlined in the *ICT in Education Strategy and Implementation Plan for Education in Papua* (The World Bank, 2010), relate to objectives of:

- Improving the ICT infrastructure: Connectivity and Equipment
- Improving Education System Monitoring and Financial Management
- Enhancing the Capacity of Education Staff
- Developing and Disseminating Teaching and Learning Resources

Considering whether the objectives have been achieved, principals in their surveys were invited to provide their responses about the past four years and indicate improvements.

Dinas Pendidikan leaders were similarly asked to respond within their interviews, although most were newly appointed and unable to provide clarity and detail.

11.1.1 Improving the ICT infrastructure: Connectivity and Equipment

A key objective of the 2010-2014 ICT strategy was about improved ICT infrastructure, connectivity and equipment, Sixty ICT Centres were planned across twenty regencies, with further secondary schools receiving smaller ICT installations. SD schools gained basic stations comprising a single laptop and other infrastructure as required. The 60 ICT Centres, generally in SMK and SMA schools, were provided with hardware such as laptop computers, one server computer, a VSAT terminal and if necessary, an alternative power source.

Throughout this report, survey and interview responses about infrastructure, Internet connectivity and ICT equipment have been outlined, especially in Chapter 6 in regarding to Internet connectivity and Chapter 8 regarding ICT hardware. Internet availability and connectivity is one aspect of particular concern for principals, teachers and students in all locations but especially in some regencies. Lack of computers and laptops or broken equipment has also emerged as a key issue across many locations and specific school sites.

Principals' survey responses to three questions about whether there have been improvements in the past four years in terms of infrastructure, connectivity and equipment indicated varying responses (N=220), according to regency. As shown in Appendix I, 27.7% and 26.6% of principals respectively believed that improvement to infrastructure and equipment had occurred 'to a great extent', but only 19.2% responded similarly for ICT connectivity (see Table 34). Only 11.1% of Supiori principals and less than 10% of Lanny Jaya principals indicated 'to a great extent' for infrastructure improvement. Equipment improvements and responses about Internet connectivity approximated 5% for principals from these regencies. Generally, about 40% of Supiori and Lanny Jaya principals gave 'not at all' responses for improvement of aspects of infrastructure, ICT connectivity and equipment improvements.

Table 34: ICT Connectivity improvements

ICT connectivity improved	All N=220 %	Jayap N=28 %	Keerom N=31 %	Merauke N=54 %	Boven Digoel N=12 %	Nabire N=50 %	Supiori N=18 %	Lanny Jaya N=23 %	Deiyai N=4 %
To a great degree	19.2	17.9	29.0	24.1	16.7	20.4	5.6	4.3	25.0
To some degree	42.5	46.4	54.8	38.9	25.0	46.9	33.3	39.1	25.0
Not at all	20.1	21.4	9.7	16.7	25.0	8.2	50.0	39.1	25.0
Don't know	18.2	14.3	6.5	20.4	33.3	24.5	11.1	17.4	25.0

Appendix I provides other relevant tables.

11.1.2 Improving Education System Monitoring and Financial Management

A key objective of the 2010-2014 ICT strategy was to improve education systems monitoring and financial management. This objective was about increasing participation in education management processes and included schools using simple spreadsheet-based reporting tools. These tools were proposed to provide standardized information for a central internet based Education Management Information System (EMIS).

Throughout this report, survey and interview responses about these aspects have been outlined. Principals and teachers have indicated how they use laptops, the Internet and Excel and Word software to undertake tasks such as record keeping about student attendance, and assessment and in reporting to parents. Chapter 7 in this report provides this information.

Principals' survey responses to two questions about whether there have been improvements in the past four years in terms of educational management and educational reporting were generally positive, although some regency variations were evident. As indicated in Table 35, 37.3% of overall respondents indicated educational management had improved 'to a great extent' and 45.0% believed similarly for educational reporting. Almost 50% of Jayapura, Keerom, Merauke and Nabire principals provided positive responses (and sometimes above this). Less than 20% of Supiori and Lanny Jaya principals provided similar responses for

improvements in educational management and educational reporting (Appendix I, Table I4). Approximately 30% 'not at all' responses for each of these aspects were received from principals from these regencies.

Table 35: Educational management improvements

Educational management improved	All N=220 %	Jayap N=28 %	Keerom N=31 %	Merauke N=54 %	Boven Digoel N=12 %	Nabire N=50 %	Supiori N=18 %	Lanny Jaya N=23 %	Deiyai N=4 %
To a great degree	37.3	60.7	51.6	44.4	25.0	44.0	16.7	21.7	25.0
To some degree	37.7	28.6	41.9	33.3	25.0	32.0	33.3	39.1	25.0
Not at all	9.1	3.6	0	5.6	8.3	2.0	38.9	26.1	25.0
Don't know	15.9	7.1	6.5	16.7	41.7	22.0	11.1	13.0	25.0

Appendix I provides other relevant tables.

11.1.3 Enhancing the Capacity of Education Staff

A further key objective of the 2010-2014 ICT strategy was about enhancing the capacity of education staff. Capacity building included relevant staff developing the technical and management skills required for operating school-based ICT. It required the building of ICT leadership skills of principals and the basic computer skills of teachers and staff in education offices. The role of Teacher Education Institute staff in supporting the professional development activities was also highlighted in the strategy.

Throughout this report, survey and interview responses have been presented about professional development activities relating to TV-Edukasi and other ICT programs. Other programs relevant to teaching and learning and administration occurring within ICT Centres and other locations were also reported and discussed.

Responses have generally been positive about professional development activities in which teachers and principals participated, and they have been described as relevant to ICT programs. As outlined in Chapter 9 of this report, for those persons who participated in TV-Edukasi or ICT Centre professional development, over 95% reported a positive response.

The issue raised by many is that they are not being provided with access to professional development relevant to the ICT programs. This access is about having professional development relating to more creative uses of ICT to support teachers in developing improved teaching and learning, and supportive of a wider range of pedagogical practices. Provincial, regency and school led professional development opportunities in a formal sense are described as lacking. All survey respondents have indicated that teacher learning generally happens through collaboration with peers rather than through any coordinated processes. While this type of professional learning is very useful and important, there is a need for more formal intervention, especially in relation to pedagogies appropriate to digital technologies.

11.1.4 Developing and Disseminating Teaching and Learning Resources

Developing and disseminating teaching and learning resources was a key objective of the 2010-2014 ICT strategy. This objective sought to ensure teachers and students were provided with high-quality learning resources through BPP evaluating and developing supporting materials. This included BPP being involved in multicasting electronic content for downloading by schools with limited or expensive connectivity. It was also about BPP's role in the dissemination of learning resources throughout Papuan schools.

Throughout this report, survey and interview responses about these aspects have been outlined especially for TV-Edukasi and also in regard to associated CDs/DVDs. TV-Edukasi was switched off since 2012 and as significant numbers of respondents have been in their positions for less than five years, many principals and teachers indicated minimal use of TV-Edukasi. Their affirmative responses were probably relevant to both use of TV-Edukasi (at the time when it was operating in Papua) and to current use of TVE CDs and DVDs.

Principals' survey responses to two questions about whether there have been improvements in the past four years in terms of student access to education resources (see Table 36) and also teacher access indicated that this was the case for about 30% of all respondents. Approximately 25% of Supiori, Lanny Jaya and Deiyai respondents provided 'not at all' responses Table I6 and I7 in Appendix I provide details.

Table 36: Students access to education resources improvements

Student access to education resources improved	All N=220 %	Jayap N=28 %	Keerom N=31 %	Merauke N=54 %	Boven Digoel N=12 %	Nabire N=50 %	Supiori N=18 %	Lanny Jaya N=23 %	Deiyai N=4 %
To a great degree	27.3	28.6	35.5	29.6	25.0	34.0	5.6	8.7	25.0
To some degree	36.8	46.4	45.2	31.5	33.3	34.0	44.4	34.8	25.0
Not at all	16.4	17.9	9.7	18.5	8.3	6.0	33.3	30.4	25.0
Don't know	19.5	7.1	9.7	20.4	33.3	26.0	16.7	26.1	25.0

Appendix I provides other relevant tables.

11.2 Resourcing of ICT programs

11.2.1 TV-Edukasi and other associated ICT programs

Throughout various chapters of this report, the TV-Edukasi program and the associated hardware and survey findings about perceived use and usefulness have been presented.

It is difficult to provide accurate information about the cost of all of the programs. Education authorities approached have been unable to supply this information. However for the purposes of this evaluation, the following estimations have been made in regard to TV-Edukasi, specifically relating to hardware costs. Additionally, freight costs need to be added.

TV-Edukasi involved hardware components such as TV/TVRO and DVD players. For some locations, generators and solar panels need to be included. Estimated costings, based on ToR data about how many items were disseminated and estimating numbers of schools from the survey data outlined in the report are as shown in Table 37.

Table 37: Estimated costings for TV-Edukasi

Component	Details	Overall estimated costs \$US
TV & TVRO	2006-2011 estimate figure: 1662 units @ \$750 each+	1,246,500
Generator*	180 units @ \$1700 estimated cost per unit	306,000
Solar power*	190 units @ \$7000	1,330,000
DVD players	689 units @ \$750	516,750
Freight etc	1135 schools @ estimated costs averaged at \$600 per school	681,000
Satellite costs*	660 schools @ estimated costs \$10000 per school	6,600,000
Estimated total costs		\$10,680,250
Estimated cost per school provided with equipment (based on 1135 schools)		\$9,409 per site

* only relevant for some locations

+ multiple items provided to some locations

For this evaluation, estimated costings for the Learning Resources development design, development and dissemination in relation to CDs and DVDs and also for the ICT Centres were also considered. The *ICT in Education Strategy and Implementation Plan for Education in Papua* (The World Bank, 2010:12) provides some intended costings, these being US\$1,151,000. It is unclear whether all of this money was expended on the Learning resources component of the program.

11.2.2 ICT Centres

The evaluation team considered expenditure for the establishment of ICT Centres, mini labs and SD stations. Operational costs, technical assistance and professional development and consultant fees, information management, infrastructure, learning resources development and dissemination (through BPP), were also considered. The 60 ICT Centres (in 20 districts and generally in SMK and SMA schools), were provided with hardware such as laptop computers, one server computer, a VSAT terminal and an alternative power source.

Details of costings, as outlined in *ICT in Education Strategy and Implementation Plan for Education in Papua* (The World Bank, 2010:13), are indicated in Appendix J. The teacher professional development cost includes development of materials and professional learning implementation costs for the basic ICT course, ICT integration, ICT leadership, and SD ICT program (US\$7,638,194 total). Given that a total of 9227 teachers or leaders were intended to participate in the any one of the courses (The World Bank, 2010), the cost per participating teacher/leader for professional development can be estimated as US\$827. Participating teachers were expected to train others in their schools and networks.

The overall estimate for all aspects of the *ICT in Education Strategy and Implementation Plan for Education in Papua*, including teacher professional development and other amounts, is indicated as \$30,892,768 (The World Bank, 2010:11). By removing the teacher professional development costs of US\$7,638,194 from calculations (as described previously), US\$23,254,574 was the estimated cost for other strategies. Based on the 1078

schools intended to receive the ICT hardware (The World Bank, 2010:11), a per site expenditure of \$21,571 per school is evident.

11.2.3 Summary regarding resourcing of ICT programs

There are some questions about the costs of ICT programs on a value for money basis when considering TV-Edukasi and other online resources and materials and also given the survey results. The survey results have indicated non-working of much of the equipment provided in packages, low use of the CDs/DVDs and difficulties with internet connectivity.

Similarly regarding ICT Centres, given survey and focus group results, and the issues indicated about power source appropriateness or internet connectivity and costs, there are again questions here to be considered. However, the majority of the ICT Centres do have equipment in working order and there have been further resources provided to update the facilities. The motivation for additional spending has been in preparation for these locations to be used as competency testing centres and also in the future in regard to national examinations being online for students.

11.3 Summary of key findings

This report outlines the finding for the surveys, school interviews and focus groups and also interviews with educational and TEI leaders and with telecommunications officials.

Key findings from this report can be summarised.

- This evaluation is about TV-Edukasi but this was switched off in 2012 and is no longer accessible for Papuan schools.
- Infrastructure issues of telecommunication and power are problematic but some improvements will occur with the Palapa Ring East being operational in some locations in the near future.
- There is a lack of clarity about any planned improvements in power and telecommunications for the most remote locations.
- There is an absence of reliable baseline data and often what was found was contradictory within and beyond a specific data set.
- ICT professional development was beneficial when it was available and accessed.
- Minimal student ICT use at school was occurring but students were using it at home in many regency locations and many students have mobile phone technologies.
- Hardware is lacking in schools and there is low budget spending for ICT, with no tablets being evident and with students generally not being allowed to bring their own devices to school.
- Minimal system-led ICT professional development is occurring, with most professional development happening through peer learning. Subject groups in districts for SMPs have been indicated as useful.
- Teachers are using ICT at home and are using laptops and other ICT at school mostly for administration and lesson preparation, although less so in the classrooms.
- Minimal pedagogical understanding about using ICT to improve student learning is evident.
- About 75% of principals especially in remote, rate themselves as having low skills in ICT capability and many are in the early years of using ICT for administration and for teaching purposes.
- Minimal systematic ICT planning and implementation is not evident. School principals believe that professional development is the responsibility of government.

- Minimal ICT infrastructure is available and minimal pedagogical training is occurring within teacher preparation courses, with TEIs not involved significantly in the professional development of teachers and leaders to any great extent with regard to ICT.
- Principals, teachers, parents and students value ICT for learning.

11.4 Findings related to research questions

In terms of the research questions outlined earlier in this report, the above findings can be related to the research questions in the ways described in the following section of this chapter.

11.4.1 Research area 1: An initial assessment of the access and reach of ICT infrastructure in Papua.

The related research questions for research area 1 are:

- What is the penetration of broadcast television (FM), Internet services (PSTN, ADSL, LEOS & MEOS) and mobile/cell phone services (GSM)?
- What infrastructure was intended for TVE and the five other ICT programs?

The penetration of broadcast TV, internet services and mobile phone services was outlined in detail in Chapter 3 of this report.

The infrastructure intended for TVE and other ICT programs was described in Chapter 4.

Policy implications about which type of ICT programs will be most appropriate for which level of connectivity will be outlined in a forthcoming section of this chapter. It is expected that the fibre-optic Palapa Ring East infrastructure will bring improvements for telephony and Internet connectivity for some locations and relocated satellite facilities will be available for other locations. For more remote locations as indicated in Chapter 3, given lack of a business case for commercial telecommunication suppliers to make improvements, it is essential for education that innovative and sustainable products such as 'telco in a box' and alternative energy sources are invested in and trials implemented. This will advantage schools and communities and requires a whole-of-Papua commitment from across education and other services. Given improvements to these innovative products within 12 months and 4G capability in the near future, connection to the worldwide web becomes imminent.

11.4.2 Research area 2: systems implementation

Systems framework implementation questions regarding vision and political commitment; ICT infrastructure; teaching and learning; learning materials; skills development; institutional arrangements, were referred to in Chapter 1 of this report.

11.4.2.1 Vision and political commitment

The related research questions for research area 2 and vision and commitment are

- What policy, management strategies, structures and plans have been put in place at provincial and district level to ensure successful installation, maintenance and use of TV-E and other ICT equipment in Papua?

Policy, management strategies, structure and plans at provincial and regency/district level towards successful installations, maintenance and use of TV-Edukasi and other ICT equipment in Papua, have been presented in various chapters of this report. Chapter 4 outlined the responsibilities of Pustekkom, provincial government, BPP and Dinas Pendidikan and schools. The challenges of ensuring coordination across all of these groups has been noted. Information is provided in Chapter 5 of this report about the implications of decisions to broadcast from Jakarta. The time difference and cultural distinctiveness between Java and Papua are seen as problematic and challenging. At the time of this research, TV-Edukasi had ceased operating in the province, with the services suspended in 2012.

11.4.2.2 ICT infrastructure

The related research questions for research area 2 regarding ICT Infrastructure are :

- Are the TV-E packages in working order?
- What other ICT infrastructure (other than TV-E packages) do schools have to complement the TV-E program? Are they in working order and how was the equipment obtained?
- How did/ who made the decisions on which schools should receive which ICT tools?
- Considering the remoteness of many schools, how are Papuan schools sourcing energy to use ICT? What are the strengths and weaknesses of different sources of energy (including renewable energy sources)?

With regard to ICT infrastructure, as outlined in Chapter 5, various items were distributed to various locations, including some schools being provided with power sources and satellite antennas. Principals report some items of TV-Edukasi being in working order. However, many hardware items were reported from across all respondents (principals, teachers, students), as being broken and unable to be used. For example, for about half of the schools given parabolic antennas and also the genet/solar/mini-hydro, their current status was indicated as being broken.

It has been difficult to ascertain decision-making processes about which schools received the package, given that many Dinas Pendidikan officials are relatively new to their roles and much of the TV-Edukasi distribution occurred in 2006-2007. While the principal surveys and interviews with various persons sought information about non-formal learning and community learning centres, virtually no information was obtained apart from that briefly outlined in Chapter 5 concerning a community centre in Merauke.

Regarding power, many survey and focus group respondents in urban and peri-urban locations indicated unreliability of this service. Data indicated that some schools in various locations are using either generators, solar or mini-hydro. Comparative information about the merits of various power services were outlined in Chapter 3. Chapter 7 provided details of other ICTs such as laptops and computers and their use in schools for teaching and learning and administration.

11.4.2.3 Teaching and Learning

The related research questions for research area 2 regarding teaching and learning is:

- How is the TV-E being used for teaching and learning?
- How are other ICT equipment being used for teaching and learning? Are they being used to complement the TV-E program or in a separate program?

Considering sub-questions about Teaching and Learning, Chapter 5 provides detail about TV-Edukasi and about the CDs and DVDs which have been used in recent years since the TV-Edukasi broadcast service was suspended. Principals and teachers in the survey did not report a significant use of TV-Edukasi. For those who did use TV-Edukasi broadcasts, news, sports, language and religious programs and learning about teaching approaches and resources were suggested as beneficial. CDs and DVDs were also valued by those using them although there was a narrow range of subject matter including Indonesian language, natural sciences, mathematics and physics. It was highlighted by survey participants that where good Internet connectivity existed, there was a wider range of up-to-date information readily available.

Students were accessing ICT through Computer labs and occasionally within their classrooms within various subjects. Excel, Word and PowerPoint were the focus of specialist ICT programs and little creative use of ICT was occurring. Many students flagged power and lack of ICT equipment as problematic for their learning. These ICT programs operated separately from TV-Edukasi.

11.4.2.4 Learning Materials

- What are the most watched TV-E programs for teaching and learning?
- Are the DVDs and CDs supplied to accompany the TV sets useful?
- What other ICT-based teaching and learning materials are available in schools and how are they used?

Chapter 5 describes various TV-Edukasi programs and CD/DVD materials which have been identified as beneficial. As outlined in Chapter 7, learning materials most valued were those available through digital technologies. Web-based materials for those able to access them, are highlighted by students, teachers, parents, and principals as being the most beneficial for learning.

11.4.2.5 Skills Development

- How are the ICT skills of educators and principals developed to ensure the e-readiness for TV-E and other ICT in education programs?

Regarding skills development, Chapter 9 outlines survey and interview/focus group responses available for ICT. Although the ICT strategy and TV-Edukasi indicate intended commitments from BPP and TEIs and those who accessed professional development were positive about its value, many teachers and principals had received minimal formal professional development. Subject associations for SMPs and principals within community of practice contexts operating in districts and regencies were valued but not always consistently funded and operational. Many teachers and principals suggested that they learned about ICT from their colleagues and peers.

There were indications that in the past, when more formal professional development in ICT was provided, teachers returned to their schools and were subsequently unable to access ICT equipment that would allow them to use and practice their new learnings.

11.4.2.6 Institutional arrangements

- What are the challenges and opportunities of using TV-E programs in these schools?
- How is ICT and power source equipment maintenance being carried out?
- How are the recurring costs being covered?
- How are broken/out of date ICT equipment being replaced?

The final aspect of the systems framework questions relates to institutional arrangements. In the surveys and focus groups, there were many challenges identified in regard to TV-Edukasi as well as some opportunities. Considering challenges, time differences between Papua and Jakarta, equipment breakages, lack of power in some locations and lack of cultural relevance to the Papua contexts, were described.

The CDs and DVDs were indicated as being more flexible for classroom use but only some materials were available on limited topic areas and many teachers were unaware of the availability of CDs.

Chapter 8 of this report indicates that in terms of budget allocations, schools reported spending less than Rp 2,000,000 (about US\$2000) on ICT. Much of this was spent on power or Internet connectivity or on maintenance. There was extremely limited spending on ICT hardware acquisition.

11.5 Impact of ICT on teaching and learning

The final research question is about teaching and learning impacts from ICT. Chapter 10 of this report indicates teachers, principals, parents and students believe ICT helps learning in terms of knowledge building, creativity, collaboration and independent learning. Various examples of learning from ICT were provided by students, teachers and principals.

11.6 Summary

This study was about three research areas and various associated research questions and key findings about each of these aspects have been outlined in this summary chapter.

Regarding geographical reach and telecommunications and power infrastructure, from this report can be summarised.

- Infrastructure issues of telecommunication and power are problematic but some improvements are anticipated to occur with the Palapa Ring East being operational in some locations in the near future, with benefits for internet connectivity. There is a lack of clarity about any planned improvements in power and telecommunications for the most remote locations but some possible solutions for further investigation have been outlined.
- Regarding TV-Edukasi and other specified ICT programs, there has been an absence of reliable baseline data and often what was found was contradictory within and beyond a specific data set. TV-Edukasi was switched off in 2012 and some other programs were suspended. This report provides some updated data about infrastructure in regard to these ICT programs.

Regarding implementation and vision and planning for TV-Edukasi and other ICT programs, learning programs, professional development, and infrastructure, information is summarised as follows:

- Clear roles and responsibilities for implementation at provincial, regency/district and school levels were not evident. There were few formal commitments and monitoring processes established, with changes of leadership personnel and budgets having negative impacts.
- Hardware is lacking in schools and there is low budget spending and minimal purchase planning for ICT, with no tablets being evident. Students generally are not allowed to bring their own devices to school.
- TV-Edukasi (and CDs/DVDs) and other ICT programs were valued by those using the materials and programs but usage was neither widespread nor frequent.
- Minimal student ICT use at school was occurring but students were using it at home in many regency locations and many students have mobile phone technologies.
- Teachers are using ICT at home and are using laptops and other ICT at school mostly for administration and lesson preparation, although less so in the classrooms.
- Minimal ICT infrastructure is available and minimal pedagogical training is occurring within teacher preparation courses, with TEIs not involved significantly in the professional development of teachers and leaders to any great extent with regard to ICT.
- ICT professional development was beneficial when it was available and accessed.
- Minimal system-led ICT professional development is occurring, with most professional development happening through peer learning. Subject groups in districts for SMPs and principal community of practice groups have been indicated as useful. School principals believe that professional development is the responsibility of government.
- Minimal pedagogical understanding about using ICT to improve student learning is evident.

Regarding impact on students and teachers, the following findings are evident.

- Principals, teachers, parents and students value ICT for their own learning.
- Almost 100% of students, principals and teachers believe ICTs support students in knowledge building, collaboration, creativity and independence as learners and can provide examples of learning occurring.
- About 75% of principals especially in remote, rate themselves as having low skills in ICT capability and many are in the early years of using ICT for administration and for teaching for teaching purposes.

Chapter 12: Policy Implications and Ways Forward

Building on from the previous chapters and the summary, this final chapter is about success indicators, policy implications and ways forward.

12.1 Success indicators for ICT implementation

Success indicators for ICT implementation arising from the surveys, interviews/focus groups and case studies in relation to infrastructure, successful implementation and impacts are as follows:

12.1.1 Infrastructure

Infrastructure success can be ensured when there is:

- Effective power and Internet access
- Planned provision and coordination of resources and support and synthesised and transparent processes (national, provincial, BPP, regency, Yayasan/foundation and NGO and school
- Commitment to vision, regulations, policies, strategies and political will (national, provincial, BPP, regency, Yayasan/foundation, NGO and school
- Coordinated training: national, provincial, regency, NGO and Yayasan, BPP, LPMP
- Provincial/regency regulations/accountability and rewards
- National ICT focus such as currently underway regarding national testing of students and teacher competencies

12.1.2 Implementation

Implementation success can be ensured when there is:

- Access to equipment and infrastructure: computer room, internet, computer/laptop/digital cameras etc.
- Access to teacher professional development: school based, district, peers, courses, LPMP, BPP, TEIs, NGOs and Yayasans
- Access to a range of ICT learning resources
- National and provincial, regency and school leadership vision (leading to an ICT plan), policies, accountability and reward
- Effective maintenance and security of equipment
- School/school committee/community /business partnerships and planning
- Access to a wide range of ICT learning activities and software
- Teacher understanding of 21st century pedagogical approaches involving ICT
- Teacher integration of ICT within 21st century pedagogy
- Internet and power access
- Principal skills and pedagogy and commitment
- Teacher skills and pedagogy, motivation and commitment

12.1.3 Teacher and student learning

Effective teacher and student learning can be ensured when there is:

- Individual beliefs about ICT and effective learning processes
- Positive motivation/engagement towards ICT use
- Access to learning opportunities
- Positive self-rating of ICT skills
- Opportunity to be creative, collaborate, access information, solve problems, become an independent learning and a global citizen
- Teacher preparation course at KPGs and universities

These success indicators provide a package of strategies to guide policies. It is proposed that these aspects operate as a package which may be considered to have the greatest potential to lead to achievement of outcomes.

12.1.4 Policy and competency frameworks for supporting ICT success

As outlined in this report, Chapter one of this report introduced the UNESCO *Guide to Measuring Information and Communication Technologies (ICT) in Education* and indicators which provide guidance for some significant policy questions. Some key domain areas outlined were Political commitment, Infrastructure, Teaching staff development; Curriculum; Usage; Participation, skills and output; Outcomes and impact.

Policy questions outlined relate to:

- whether policies and incentives were in place for ICT integration
- extent schools had access to ICT infrastructure to support teaching and learning
- competencies of staff to adapt to ICT enabled instruction model
- curriculum delivery changes using ICT and degree to which ICT taught as a subject
- nature and intensity of ICT use in schools
- evolution in structure of skills/outputs produced annually by national education system
- whether ICT is transforming education system and improving conventional teaching and learning; enhancing quality of student performance; expanding new skills for the labour market; enlarging lifelong learning opportunities; enhancing management of education institutions.

The UNESCO *ICT Competency Framework for Teachers* (2011) and MoEC (Indonesia) *ICT Competency Framework for Teachers* (2012) as outlined earlier in this report, also provide some useful models. This is particularly the case in terms of policy aspects about competencies of staff to adapt to ICT-enabled instruction models and whether ICT in transforming the education system, improving conventional teaching and learning and building of a wider range of student skills.

This current study seems to indicate that, in terms of competency frameworks, most teachers are operating at the lowest level of *literacy* at best, in terms of the various domains of Policy, Curriculum and assessment; Pedagogy; ICT; Organisation and administration and Professional Development. The evidence for this idea arises because many teachers and especially principals, do not self-rate as 'capable' (let alone 'very capable'). Indeed, about 75% of principals and 41% of teachers rate themselves 'not at all capable'. The use of ICT in classrooms is low as evidenced by teacher, principal and student results, especially its use on a regular basis such as at least weekly. Teachers seem to use ICT for basic administration tasks rather than as part of the ongoing pedagogies in the classroom or with awareness of the links to 21st century learning and as outlined in the frameworks for knowledge deepening, knowledge creation and knowledge sharing such as for problem based learning or collaborative work.

Considering wider policy aspects, there is a vision for ICT in Indonesia and there is a vision for ICT in education in Papua, as outlined throughout this report. There are professional development opportunities and there is some degree of political commitment. Access to sufficient ICTs in the school context and to appropriate digital learning and internet infrastructure, is a significant issue. Coordinated implementation and monitoring and planning and commitment at all levels and within binding contractual contexts, are aspects needed.

These frameworks and international policy contexts are relevant to the policy implications for Indonesia as will now be outlined.

12.2 Policy implications

Principals, teachers, parents and students indicated the value of ICT for learning and believed that it impacts positively. It is very important that education leaders at all levels continue to develop and coordinate ICT plans and then to fund and implement these. The right equipment, time for appropriate professional learning and investment into ongoing monitoring of expenditure, quality and impacts, are further essential requirements for success.

At a provincial and national level, priorities for successful and sustainable ICT uptake relate to:

- Developing an across government plan and/or policy (e.g Joint Decree across Ministries) and resources, which allocates resources to improve telecommunications and power infrastructure such that all locations in Papua have access to these services. This in turn will improve internet connectivity generally and give remote schools better access to web based materials.
- Negotiating with various funders to ensure sufficient and targeted budgets are provided. This will enable Papuan provincial authorities to develop detailed long-term plans outlining both subsidies for devices, technical support, maintenance and professional development, and processes for monitoring.
- Developing a coordinated plan and implementing strategies for ICT in schools including clear roles for provincial bodies such as BPP, TEIs, LPMP, districts and schools and sufficient and sustainable funding and monitoring.
- Reconsidering policies about provision of ICT equipment and ensuring there are clear formal responsibilities outlined, using subsidies which seek commitment in terms of contributory funding, and more synthesised approaches to planning and monitoring.
- Establishing and implementing a coordinated professional development plan for ICT using expert advice focused on relevant pedagogies and integration of ICT into subjects, including a mix of specialist sessions. Furthermore, establishing communities of practice at the school and district level and through professional associations to underpin professional development through peer-to-peer learning.
- Revisiting ICT professional development focal areas to ensure a greater emphasis on building an understanding across all leaders and teachers about the potential for ICT to develop 21st century skills. Aspects of this will include problem solving, collaboration, creativity, independent learning.

At the regency/district level, priorities for successful and sustainable ICT uptake relate to:

- Supporting and strengthening district based subject and leader communities of practice groups and establishing expectations for schools to create in-school groups. Also providing time for school-based community of practice groups to meet regularly, formally and informally and to support each other in ICT skills and knowledge development.

- Developing targeted PD for female teachers and leaders, as well as for more mature staff and for those in remote locations to build their ICT skills.
- Developing a coordinated plan and implementing strategies for ICT in schools including clear roles for TEIs, LPMP, districts and schools and with sufficient funding and monitoring to ensure success.

At the school level, priorities for successful and sustainable ICT uptake relate to:

- Establishing communities of practice within the school which meet regularly, with teachers supporting each other in ICT skills and knowledge development, including sharing pedagogies which enhance student skills as independent learners and knowledge builders.
- Developing a school plan which builds a positive ICT culture and implementing strategies, with sufficient funding and monitoring to ensure success.

12.3 Ways forward

Aligned to the policies, some key ways to move forward relate to improving infrastructure and creating coordinated systems approaches to ICT development. Simultaneously, there should be focus on systematic professional learning to build pedagogical skills (as relevant to phase 2 (knowledge deepening) and 3 (knowledge creation) of the UNESCO *ICT Competency Framework for Teachers* (2011)/Indonesian *ICT Competency Framework for Teachers*). There is a need to consider student teacher preparatory programs for ICT, to provide additional budget for schools, and to require planned ICT spending and subsidies for teachers, principals, students and parents for ICT purchases.

Specifics for this roadmap moving forward are as follows:

Area 1: At the broader level, it is essential that solutions for sustainable power and improved telecommunications infrastructure are investigated and acted on, building on innovations which are underway in remote locations, and using schools as focal points with related benefits occurring for communities e.g. health, childcare:

- Innovations in sustainable power need further action including those related to solar, wind and hydro. The simplest of solutions for remote schools could be the provision of solar power bricks to recharge laptops, tablets and similar ICT devices.
- To enhance reliable telecommunications, innovations in this field must be acted on. The current costs of a 'telco in a box' is US\$51,000, and includes a telco box (\$6000), VSAT (\$20,000) + technical support (\$15,000) and solar power facility (\$10,000). This system has potential for additional sub-stations at the cost of \$10,000 per location within a 100 km radius where line of sight is available. A pilot in one regency covering multiple sites can provide information on how to move this innovation forward across Papua

Area 2: A systematic, coordinated and sustained approach to ICT development in Papua is required. It must include an increased range and quantity of equipment, specialist ICT coordinator staff at regency/district levels, technical support and monitoring. This process will involve Provincial, regency, district, and school levels, with planning occurring in an integrated manner and with sufficient resourcing and timeline to enable programs to be sustained and maintained into the future.

To achieve this will require the development of:

- A Standard Operating Environment: all devices have the same look and feel.
- Processes for monitoring progress and reporting: contributing to sustainability.
- Differentiated teaching and learning practices in the Papuan context e.g. UNESCO Teaching and Learning for a Sustainable Future.

- Professional development of educational leaders and teachers.
- Sufficient infrastructure to enable national competency testing for teachers and leaders.
- Adequate infrastructure to enable national assessment and examination of students.

Area 3: There is a need for ICT professional learning (provincial, TEI, district, school based) related to updating the skills of all teachers and leaders (especially female, more mature and those in remote locations), and building pedagogical skills. In ICT, pedagogical skills must be a focus for all principals and teachers, and these pedagogies need to move towards integration with the curriculum for the purpose of knowledge deepening and knowledge creation and enhancing 21st century skills. Skills such as student creativity, group work, deep learning, problem solving must be a part of this. Province, TEIs, regency/districts and schools need to establish a coordinated approach, with specialist ICT coordinator leaders providing this, especially at regency levels.

To achieve this, educational planning will include:

- Recognising and understanding the cultural context of Papua.
- Building sample guides and case studies to illustrate differentiated learning opportunities.
- Developing a learning and competency framework in this context.
- Monitoring the implementation of the learning and competency framework in a broad consultative process.
- Highlighting, rewarding and sharing stories of best practice/s.
- Establishing online and face-to-face networks for professional collaboration.

Area 4: The planning and implementation of flexible student teacher preparation programs within universities and KPGs is necessary for the successful integration of ICT across the curriculum, in accordance with the expectations of Curriculum 2013. Universities and KPGs must be funded for the acquisition of facilities and staff to focus on ICT integration and related pedagogical issues.

This will require:

- A curriculum in universities and KPGs that:
 - Recognises and understands the cultural context of Papua, while building knowledge and 21st century skills using ICTs.
 - Builds sample guides and case studies to illustrate differentiated learning opportunities.
 - Builds on a common learning framework that contextualises the above.
 - Monitors these programs in universities and KPGs by LPMP.
 - Shares stories and promotes best practice/s among professional networks.
- Academic and professional staff who are steeped in the pedagogies and practices of ICT integration.

Area 5: School budgets that target ICT must be provided. This includes ICT related expenses such as network infrastructure (external, internal to school), digital devices, training and professional learning activities, sharing good teaching practices, technical support and maintenance, and provisions for safety and security.

To achieve this, education authorities must require:

- Three year school plans developed specifically for ICT acquisition, maintenance, and teacher professional development.
- The purchase of a wider range of equipment to enhance classroom integration of ICT such as laptops, tablets etc.
- Participation in online and face to face networks and professional associations.
- Monitoring and accountability procedures for the above to ensure that they are achieved.

Area 6: Sustained and ongoing provision of subsidies for the purchase of government-preferred ICT equipment must be actioned. This will enable all schools to purchase from a range of digital devices (e.g. laptops, ultra-portables, tablets, mobile phone technologies etc), that can be used for educational purposes for student and teacher use.

To achieve this it will be necessary to establish:

- Preferred ICT device, ICT equipment and ICT network suppliers, with appropriate service level agreements in place.
- Preferred school network, installation and maintenance contractors, with appropriate service level agreements in place.
- Government technical support.
- Help centres for school staff.

12.3.1 Staged implementation of ways forward

Six directions in terms of ways forward have been outlined. Appendix K provides details of indicative ICT program costs for these actions.

There are some caveats that should be considered before any broad scale deployment occurs as suggested in Appendix K and elsewhere. Rigorous systems need to be in place around procurement, deployment, maintenance and provision of infrastructure and other hardware. The limited ‘trial’ of managing such a wide deployment has been the subject of this evaluation of TV-E and other ICT programs. If there is to be a sustainable and effective ICT program developed, systems and processes should be put in place. Before a broader deployment occurs, it might be helpful to undertake a trial of all processes in a very limited set of regencies. This will allow for rigorous monitoring and evaluation. Adoption of this report and its recommendations and policy directions will require careful consideration by a representative and balanced Reference Group.

The forthcoming section suggests that the program be implemented over at least three years and that there be constant monitoring. This latter activity provides assurances that the public funds allocated have been expended for the intended purpose and to ensure that where necessary, timely variations can be made based on quality data. Allowing a period of time for a complete deployment has less impact on budget, a necessary consideration. Deployment in a phased rollout will cause angst for those schools not in the first round. This is unavoidable. Selection of regencies for each phase will need to be carefully considered in the light of existing infrastructure, yet at the same time it will need to be cognizant of the solutions to barriers that are proffered in this report. For example, solar Power Packs could be supplied to schools that do not have electricity available during the school day. As many of these schools are small, the expense of 20-30 Power Bricks is insignificant against the impost of a full solar setup.

Table 38 provides details of the staged implementation of actions outlined as ways forward for ICT in education in Papua province.

Table 38: Staged Implementation of Ways Forward

Area	Activity	Year 1		Year 3
		Phase 1 regencies	Phase 2 regencies	Phase 3 regencies
AREA 1 Sustainable power & telecommunications infrastructure	Finance and Procurement plan	2-3 months	-	-
	Development of tender documents; Tenders assessed		-	-
	Purchase/installation of materials for Telco in a Box trial		-	-
	Monitoring & evaluation of this Phase		-	-
AREA 2 Coordinated approach to ICT development	Strategic planning and change workshops	2 months	-	-
	Development of plan for TPD materials/training plan	Undertaken by BPP	-	-
	Decisions around TRIAL regency/s	Decided and agreed by National Reference Group	-	-
	Monitoring & evaluation of this phase	Ongoing with input from International Monitoring & evaluation adviser	-	-
AREA 3 ICT professional learning	Actioning Materials Development plan from Area 2	6 months	-	-
	Train the Trainer workshops	3 months	3 months	3 months
	Monitoring & evaluation of this phase	Ongoing with input from National Monitoring & evaluation adviser	Ongoing with input from National Monitoring & evaluation adviser	Ongoing with input from National Monitoring & evaluation adviser
AREA 4 Student teacher preparation	Development of TEI Plan and Curriculum	3 months		
	Purchase of 20 laptops under process			
	TEI PD workshops	1 month		
	Monitoring & evaluation of this phase	Ongoing with input from National Monitoring & evaluation adviser		

Area	Activity	Year 1		Year 3
		Phase 1 regencies	Phase 2 regencies	Phase 3 regencies
AREA 5 School budget for ICT	School Budget processes developed centrally	2 months		
	Monitoring & evaluation of this phase	Ongoing with input from National Monitoring & evaluation adviser		
	Schools selected submit ICT purchasing plan	Phase 1 schools	Phase 2 schools	Phase 3 schools
	Regencies assess School ICT Plans against provincial guidelines	6 weeks	6 weeks	6 weeks
	Monitoring & evaluation of this Phase	Ongoing with input from National Monitoring & evaluation adviser		
AREA 6 Subsidised provision of ICTs	Schools in first phase of deployment receive hardware	Phase 1 schools	Phase 2 schools	Phase 3 schools
	Ongoing Monitoring & evaluation of this phase	Ongoing with input from National Monitoring & evaluation adviser	Ongoing with input from National Monitoring & evaluation adviser	Ongoing with input from National Monitoring & evaluation adviser

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